

SOUTH FIELD, LAND TO THE SOUTH OF CAWSTON ROAD, AYLSHAM, NORFOLK

DETAILED MAGNETOMETER SURVEY



Report Number: 1051 March 2014



SOUTH FIELD, LAND TO THE SOUTH OF CAWSTON ROAD, AYLSHAM, NORFOLK

Detailed Magnetometer Survey

Prepared for:
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Aylsham
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Site Code	ENF132560	NGR	TG 1830 2592
Planning Ref.	n/a	OASIS	britanni1- 173878
Approved By	Matthew Adams	Date	March 2014



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ABSTRACT

This survey was successful in recording anomalies of a higher archaeological potential than those recorded in the two previous geophysical investigations. The preceding survey phases revealed an overall picture of dispersed rubbish pits or tree throws and hollows in a landscape dominated by later Iron Age, Roman, post-medieval and modern agricultural activity with only curvilinear trends providing weak evidence in support of a potential archaeological settlement. Stronger evidence of industrial activity however was recorded in the western field with two potential kiln sites.

The current phase revealed perpendicular and parallel positive and negative linear trends, that form five distinct enclosures connected on their northern boundary with an east to west running trackway. A plethora of discrete anomalies in and around these enclosures indicates the presence of rubbish pits, burnt pits and potential hearths. This activity appears to continue into the western field, but has been damaged by modern quarrying on its eastern extent.

Further investigation by trial trenching would help test the interpretations given in this report while evaluating the form, function and state of preservation of anomalies likely to be of archaeological origin.



1.0 INTRODUCTION

On Thursday 20th February and Tuesday 4th March 2014, Britannia Archaeology Ltd (BA) undertook detailed fluxgate gradiometer survey over *c*.2 hectares of land at Woodgate Nursery, Cawston Road, Aylsham, Norfolk (TG 1830 2592), on one field currently under pasture and two grids within the garden of Woodgate House. It forms the third survey stage of a programme of archaeological research investigations carried out within the area (see Figure 5).

This survey was undertaken on behalf of the land owner Mr Peter Purdy with the approval of Dr Ken Hamilton of Norfolk County Council Historic Environment Team (NCC HET). The weather was overcast and raining on the first day, following a period of prolonged precipitation. Sunny conditions with no cloud cover prevailed on day 2 causing the instrument to drift to a slightly higher degree than on day 1.

2.0 SITE DESCRIPTION

Phase 3 of the survey was undertaken in one field, on land under pasture at a height of c.30 m AOD. The site is located to the south of the formal lake of Woodgate House and was bordered to the south, north, east and west by a metal fence. A 5m exclusion zone was kept around the periphery of the field due to the presence of this ferrous boundary. Two further grids were also surveyed in the garden of Woodgate House.

The bedrock is described as Wroxham Crag Formation sand and gravel, a sedimentary bedrock formed up to 2 million years ago in the Quaternary Period when the local environment was dominated by swamps, estuaries and deltas periodically inundated by the sea (BGS, 2013).

The superficial deposits are described as Mid Pleistocene Glaciofluvial Deposits of sand and gravel formed up to 2 million years ago in the Quaternary Period when the local environment was dominated by ice age conditions with glaciers scouring the landscape depositing moraines of till with outwash sand and gravel from seasonal and post glacial meltwaters (BGS, 2013).

3.0 ARCHAEOLOGICAL BACKGROUND

The archaeological background summarises finds and features located on the Norfolk Heritage Explorer Website.

This survey was undertaken within the grounds of the Grade II* Listed Woodgate House (12216) that was built between 1706 and 1726. Kiln fragments were discovered during the last ploughing season and was the principal reason why a magnetometer survey was employed in the northern fields. A plethora of Roman pottery has been collected by the landowner, a ceramic concentration in close proximity with two very strong dipolar discrete responses (potential kilns) was recorded in the western field in 2013 (Schofield,



T. P. 2013, R1041). The preceding eastern field survey phase (Schofield, T. P. 2014, R1044) revealed an overall picture of dispersed rubbish pits or tree throws and hollows in a landscape dominated by later Iron Age, Roman, Post-medieval and modern agricultural activity with only curvilinear trends providing weak evidence in support of a potential archaeological settlement. The current survey location has been chosen to evaluate an area of land present to the south of the formal lake.

In the fields to the north of Cawston Road a detailed magnetometer survey was carried out over 20 hectares in 2011 by ASWYAS (Webb, A. 2011) followed by a subsequent trial trench evaluation by NAU Archaeology (NPS) ahead of a housing and football pitch development. This evaluation recorded some evidence of Roman activity to the south of the area, predominantly a series of late medieval and post-medieval field boundaries and trackways that were also present on air photographs. Oxford Archaeology East then undertook a large open area excavation targeting archaeological activity present within the trial trenches in the latter part of 2013. These excavations revealed dispersed prehistoric pits (one containing a complete Beaker vessel), tree hollows and tree throws providing evidence for a previously forested area with no real evidence of settlement activity. A long period of agricultural activity is thought to have then started in the Late Iron Age and Roman epochs, evidenced by widely distributed ditches. Post-medieval ditches were also recorded and this agricultural pattern continued up until very recently (OAE, forthcoming report).

Bordering the field to the north of Cawston Road lies the railway embankment of the former East Norfolk Railway Line. A post-medieval brick kiln (15883) is also located 330m to the south-west of the site.

4.0 PROJECT AIMS

A detailed magnetometer survey of the area was undertaken to enable the archaeological resource, both in quality and extent, to be investigated. Specific research questions are as follows:

- Can any supporting evidence of potential archaeological activity associated with the very strong dipolar discrete anomalies, pottery cluster and kiln fragments be interpreted in the dataset to the south of the lake?
- What is the extent of these areas of archaeological potential?
- Are there any anomalies similar to those found to the north of Cawston Road recorded in the dataset?

5.0 METHODOLOGY

5.1 Instrument Type Justification

Britannia Archaeology Ltd employed a Bartington Dual Grad 601-2 fluxgate gradiometer to undertake the survey, because of its high sensitivity and rapid ground coverage. The



surveyors noted that the site had a fairly high magnetic background susceptibility which caused a degree of difficulty in locating an apposite zero station. A suitable area of low magnetic susceptibility was located in the south-western corner of the survey area.

5.2 Instrument Calibration

One hour was allowed in the morning for the magnetometers sensors to settle before the start of the first grid. The instrument was zeroed after every three grids to minimise the effect of sensor drift. An area with a relatively low magnetic reading was chosen to calibrate the instrument; this same station was used to zero the sensors throughout the survey providing a common zero point. Sensor drift was noted particularly on day two that caused 'striping' within the dataset (Figure 2).

5.3 Sampling Interval and Grid Size

The sampling interval was set at 0.25m along 1m traverse intervals, providing 4 readings a metre, the magnetometer survey was undertaken on $20 \times 20m$ grids.

5.4 Survey Grid Location

The survey grid was set out to the Ordnance Survey OSGB36 datum to an accuracy of ±0.1m employing a Leica Viva Glonnass Smart Rover GS08 differential global positioning system (DGPS). Data were then converted to the National Grid Transformation OSTN02 and the instrument was regularly tested using stations with known ETRS89 coordinates. The grids were positioned on a NNW-SSE alignment (Figure 1).

5.5 Data Capture

Instrument readings were recorded on an internal data logger that were downloaded to a laptop at lunchtime and then also at the end of the day. The grid order was recorded on a BA pro-forma to aid in the creation of the data composites. Data were filed in job specific folders. These data composites were checked for quality on site by BA, allowing grids to be re-surveyed if necessary. The data were backed up onto an external storage device in the office and finally a remote server at the end of the day. A five metre exclusion zone was left between the boundaries and the survey area to reduce the amount of field boundary magnetic disturbance which slightly reduced the area available.

5.6 Data Presentation and Processing

Data are presented in both raw and processed data plots in greyscale format (Figures 2 and 3). An XY trace plot of the processed data has also been included (Figure 4). The raw data is presented with no processing, and was clipped to produce a uniform greyscale plot. The processed data schedule is also displayed below, metadata sheets are presented in Appendix 1.



Raw Data:

South Field & Garden Area:

Data Clipping: 3 standard deviations. **Display Clipping**: 1 standard deviation.

Processed Data:

South Field:

De-spike: X diameter = 3, Y diameter = 3, Threshold = 1, centre

value=mean, replace with = mean;

De-stripe: Traverse, Median, Sensors.

De-stagger: Mode, Both, -2 intervals, Grids 12 & 13 **De-stagger:** Mode, Both, -1 intervals, Grids 16 & 20

Data Clipping: 1 standard deviation;Display Clipping: 1 standard deviation.

Garden Area:

De-spike: X diameter = 3, Y diameter = 3, Threshold = 1, centre

value=mean, replace with = mean;

De-stripe: Traverse, Median, Sensors.

Data Clipping: 1 standard deviation; **Display Clipping**: 1 standard deviation.

An interpretation plan characterising the anomalies recorded can be found at Figure 5, it draws together the evidence collated both from the greyscale and XY trace plots (Figures 2, 3, and 4). The results from the previous surveys have also been included in Figure 5. All figures are tied into the National Grid and printed at an appropriate scale.

5.7 Software

Raw data were downloaded using Bartington software Grad601 and will be stored in this format as raw data. The software used to process the data and produce the composites was DW Consulting's Archeosurveyor v2.0. Datasets were exported into AutoCAD and placed onto the local survey grid. An interpretation plot was then produced using AutoCAD.

5.8 Grid Restoration

Britannia Archaeology Ltd did not position any survey stakes within the field, however the survey grid and anomalies can be accurately relocated using the five reference stations illustrated in Figure 1.



6.0 RESULTS & DISCUSSION (Figures 1 – 5)

South Field

The surveyors noted that the sites overall magnetic background was relatively high, causing a degree of difficulty in locating a suitable zero station to set-up the instruments sensors. Ground conditions were firm underfoot and found to be suitable for survey despite the recent rainfall. The south field was set-aside to pasture and covered in short grass.

Isolated dipolar ('iron spike') responses were once again most numerous (see previous survey areas), some of which may relate to buried archaeological artefacts, but equally may be ferrous material introduced into the topsoil via episodes of manuring. These responses (yellow hatched circles) seem to be fairly evenly spaced throughout the field with no apparent concentration.

Fifteen areas of magnetic disturbance (yellow hatching) were present in the dataset, most of which are located around the boundary of the survey where the metal fence has been recorded. Four areas of magnetic disturbance are present to the east of the survey area where quarrying has been undertaken in the recent past.

One dipolar linear trend (purple line) was recorded running north-west to south-east and located in the eastern third of the survey. This is believed to be the location of a buried ferrous fence of modern origin that previously sub-divided the southern field.

Fifty-one positive discrete anomalies (orange hatching) were recorded during the survey, these are indicative of cultural rubbish pits. However they may also delimit patches of a more magnetically susceptible material present within the superficial geology, or could be related to natural features such as tree throws or hollows similar to those recorded during the excavation to the north of Cawston Road (OAE, forthcoming). Many of these discrete anomalies were present in the centre of the perpendicular and parallel linear enclosure type anomalies and therefore could be associated hearths or burnt pits. Eleven positive discrete anomalies interpreted as activity associated with modern quarrying are located in the eastern third of the dataset, however an archaeological origin cannot be ruled out.

A series of parallel and perpendicular linear, rectilinear and curvilinear positive anomalies (hatched red) have been recorded throughout the centre of the dataset. Many of them have an associated negative linear trend (hatched blue) running parallel and perpendicular within close proximity. These anomalies appear to form a series of individual (potentially five) enclosures (orientated east to west and perpendicular) that appear to have an adjoining trackway present along their northern boundary (running east to west). The positive linear trends are likely to have been backfilled ditches containing material that is rich in humic and ferrous debris. The negative linear trends indicate the presence of low a magnetically susceptible medium present within the upper matrix, which may prove to be remnant bank material related to the enclosures.



Garden Area

A high degree of ground disturbance and ferrous material caused the magnetic background reading of the garden to be one of the highest witnessed in any of the surveys. This is not surprising because the garden is still in active use today. The zero station of the southern field was used to calibrate the sensors providing a common setup station between both surveys. Four areas of magnetic disturbance were present highlighting the disturbed nature of the garden area. No anomalies of potential archaeological origin were recorded.

7.0 CONCLUSION

The third phase of detailed fluxgate gradiometer survey has recorded anomalies with a higher degree of archaeological potential than any present in the previous two surveys. Of particular note are the five rectangular enclosures recorded through the centre of the dataset that appear connected by a trackway located on their northern boundary. Most of these enclosures appear incomplete and therefore may have suffered plough-damage in the past. Further enclosure type anomalies are likely to be recorded if the survey area was extended to the west. Many of the discrete anomalies located in and around the linear trends are also likely to be associated with the enclosures, further archaeological investigation should help determine their form and function. Quarrying activity appears to have damaged the eastern-most enclosure, however positive and negative curvilinear/linear trends and positive discrete anomalies recorded in this area may prove to be of archaeological origin.

The previous surveys and archaeological investigations undertaken to the north of Cawston Road have revealed activity of a mainly agricultural nature, with only the two sets of very strong dipolar discrete anomalies providing evidence for industrial (kiln) activity. This archaeological evidence suggests that the epicentre was likely to be located somewhere in the vicinity and the south field provides the clearest evidence to date of an associated settlement.

8.0 PROJECT ARCHIVE AND DEPOSITION

A full archive will be prepared for all work undertaken in accordance with guidance from the *Selection, Retention and Dispersion of Archaeological Collections,* Archaeological Society for Museum Archaeologists, 1993. Arrangements will be made for the archive to be deposited with the relevant museum/HER Office.

9.0 ACKNOWLEDGEMENTS

Britannia Archaeology Ltd would like to Mr Peter Purdy for funding the project and for arranging site access, and to Dr Ken Hamilton and Mr James Albone of Norfolk County Council Historic Environment Team for their advice and input.



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Norfolk Heritage Explorer. http://www.heritage.norfolk.gov.uk/home.



APPENDIX 1 METADATA SHEETS

SOUTH FIELD Raw Data

Filename	AYL SW2 Raw 3.xcp
Description	
Instrument Type	Grad 601 (Gradiometer)
Units	nT
Surveyed by	MCA/MB on 3/4/2014
Assembled by	TPS on 3/7/2014
Direction of 1st	90 deg
Traverse	-
Collection	ZigZag
Method	
Sensors	2 @ 1.00 m spacing.
Dummy Value	32702.00
Dimensions	
Composite Size	960 x 120
(readings)	
Survey Size (m)	240.00m x 120.00 m
Grid Size	20.00 m x 20.00 m
X Interval	0.25 m
Y Interval	1.00 m
Stats	
Max	27.93
Min	-29.49
Std Dev	5.30
Mean	-0.74
Median	-0.67
Composite Area	2.88 ha
Surveyed Area	2.04 ha
Program	
Name	ArcheoSurveyor
Version	2.5.16.0

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2			grids\02.xgd
3			grids\02.xgd
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6	Col.1	Dow:1	grids\05.xgd grids\06.xgd
			grids\00.xgd
			grids\08.xgd
9			grids\09.xgd
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49	Col:10		
50	Col:10		
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52	Col:10		4 grids\51.xgd
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54	Col:11	Row:1	grids\54.xgd
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56	Col:11	Row:3	grids\56.xgd

Processed Data

AYL SW2 Pro.xcp
Grad 601 (Gradiometer)
nT
MCA/MB on 3/4/2014
TPS on 3/7/2014
90 deg
ZigZag
2 @ 1.00 m spacing.
32702.00
960 x 120
240.00m x 120.00 m
20.00 m x 20.00 m
0.25 m
1.00 m
6.64
-6.87
2.55
0.02
0.00
2.88 ha
2.04 ha
ArcheoSurveyor
2.5.16.0

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Col:11 Row:1 grids\54.xgd
Col:11 Row:2 grids\55.xgd
Col:11 Row:3 grids\56.xgd

GARDEN AREA

Raw Data

Filename	AYL Garden Raw.xcp
Description	
Instrument Type	Grad 601 (Gradiometer)
Units	nT
Surveyed by	MCA/MB on 3/4/2014
Assembled by	TPS on 3/10/2014
Direction of 1st	90 deg
Traverse	
Collection Method	ZigZag
Sensors	2 @ 1.00 m spacing.
Dummy Value	32702.00
Dimensions	
Composite Size	80 x 40
(readings)	
Survey Size	20.00m x 40.00 m
(meters)	
Grid Size	20.00 m x 20.00 m
X Interval	0.25 m
Y Interval	1.00 m
Stats	
Max	15.22
Min	-50.01
Std Dev	18.83
Mean	-15.52
Median	-9.39
Composite Area	0.08 ha
Surveyed Area	0.06 ha
Program	
Name	ArcheoSurveyor
Version	2.5.16.0

Source Grids: 2				
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2	Col:0	Row:1	grids\58.xgd	



Processed Data

Etterness	A)//L C
Filename	AYL Garden Pro.xcp
Description	
Instrument Type	Grad 601 (Gradiometer)
Units	nT
Surveyed by	MCA/MB on 3/4/2014
Assembled by	TPS on 3/10/2014
Direction of 1st	90 deg
Traverse	
Collection Method	ZigZag
Sensors	2 @ 1.00 m spacing.
Dummy Value	32702.00
Dimensions	
Composite Size	80 x 40
(readings)	
Survey Size	20.00m x 40.00 m
(meters)	
Grid Size	20.00 m x 20.00 m
X Interval	0.25 m
Y Interval	1.00 m
Stats	
Max	20.54
Min	-37.40
Std Dev	16.91
Mean	-6.01
Median	0.00
Composite Area	0.08 ha
Surveyed Area	0.06 ha
Program	
Name	ArcheoSurveyor
Version	2.5.16.0

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	1	Col:0	Row:0	grids\57.xgd
	2	Col:0	Row:1	grids\58.xgd



APPENDIX 2 TECHNICAL DETAILS

Magnetometer Survey

The magnetometer differs from the 'active' magnetic susceptibility meter by being a 'passive' instrument. Rather than injecting a signal into the ground it detects slight variations in the Earth's magnetic field caused by cultural and natural disturbance (Clark).

Thermoremanent magnetism is produced when a material containing iron oxides is strongly heated. Clay for example has a high iron oxide content that in a natural state is weakly magnetic, when heated these weakly magnetic compounds become highly magnetic oxides that a magnetometer can detect.

The demagnetisation of iron oxides occurs above a temperature known as the Curie point; for example haematite has a Curie point of 675 Celsius and magnetite 565C. At the time of cooling the iron oxides become permanently re-magnetised with their magnetic properties re-aligned in the direction of the Earth's magnetic field (Gaffney and Gater). The direction of the Earth's magnetic field shifts over time and these subtle alignment differences can be recorded. Kilns, hearths, baked clay and ovens can reach Curie point temperatures, and are the strongest responses apart from large iron objects that can be detected. Other cultural anomalies that can be prospected include occupation areas, pits, ditches, furnaces, sunken feature buildings, ridge and furrow field systems and ritual activity (David, 2011). Commonly recorded anomalies include modern ferrous service pipes, field drainage pipes, removed field boundaries, perimeter fences and field boundaries.

Fluxgate Gradiometers

Fluxgate gradiometers are sensitive instruments that utilise two sensors placed in a vertical plane, spaced 1 metre apart. The sensor above reads the Earth's magnetic (background) response while the sensor below records the local magnetic field. Both sensors are carefully adjusted to read zero before survey commences at a 'zeroing' point, selected for its relatively 'quiet' magnetic background reading. When differences in the magnetic field strength occur between the two sensors a positive or negative reading is logged. Positive anomalies have a positive magnetic value and conversely negative anomalies have a negative magnetic value relative to the site's magnetic background. Examples of positive magnetic anomalies include hearths, kilns, baked clay, areas of burning, ferrous material, ditches, sunken feature buildings, furrows, ferrous service pipes, perimeter fences and field boundaries. Negative magnetic anomalies include earthwork embankments, plastic water pipes and geological features.

The instruments are usually held approximately 0.30m to 0.50m above the ground surface and can detect to a depth of between 1-2metres. Best practice dictates that the optimal direction of traverse in Britain is east to west.



Magnetic Anomalies

Linear trends

Linear trends can be both positive and negative magnetic responses. If they are broad, relatively weak or negative in nature they may be of agricultural or geological origin, for example periglacial channels, land drains or ploughing furrows. If the responses are strong positive trends they are more likely to be of archaeological origin. Archaeological settlement ditches tend to be rich in highly magnetic iron oxides that accumulate in them via anthropogenic activity and humic backfills. Conversely surviving banks will be negative in nature, the material is derived from subsoil deposits that is less likely to be positively magnetic. Curvilinear trends can also be recorded and are indicative of archaeological structures such as drip-gullies.

Discrete anomalies

Discrete anomalies appear as increased positive responses present within a localised area. They are caused by a general increase in the amount of magnetic iron oxides present within the humic back-fill of for example a rubbish pit.

'Iron spike' anomalies

These strong isolated dipolar responses are usually caused by ferrous material present in the topsoil horizon. They can have an archaeological origin but are usually introduced into the topsoil during manuring.

Areas of magnetic disturbance

An area of magnetic disturbance is usually associated with material that has been fired. For example areas of burning, demolition (brick) rubble or slag waste spreads. They can also be caused by ferrous material, e.g. close proximity to barbwire or metal fences and field boundaries, buried services, pylons and modern rubbish deposits.



APPENDIX 3 OASIS FORM

OASIS ID: britanni1-173878 Project details

Project name South Field, Land to the South of Cawston Road, Aylsham, Norfolk.

Detailed Magnetometer Survey.

Short description of the This survey was successful in recording anomalies of a higher

project

archaeological potential than those recorded in the two previous geophysical investigations. The preceding survey phases revealed an overall picture of dispersed rubbish pits or tree throws and hollows in a landscape dominated by later Iron Age, Roman, post-medieval and modern agricultural activity with only curvilinear trends providing weak evidence in support of a potential archaeological settlement. Stronger evidence of industrial activity however was recorded in the western field with two potential kiln sites. The current phase revealed perpendicular and parallel positive and negative linear trends, that form five distinct enclosures connected on their northern boundary with an east to west running trackway. A plethora of discrete anomalies in and around these enclosures indicates the presence of rubbish pits, burnt pits and potential hearths. This activity appears to continue into the western field, but has been damaged by modern quarrying on its eastern extent. Further investigation by trial trenching would help test the interpretations given in this report while evaluating the form, function and state of

preservation of anomalies likely to be of archaeological origin.

Project dates Start: 20-02-2014 End: 04-03-2014

Previous/future work Yes / Yes

Any associated project P1024C - Sitecode reference codes ENF132560 - Sitecode Field evaluation

Site status None

Current Land use Grassland Heathland 2 - Undisturbed Grassland

Monument type NONE None Significant Finds NONE None

Methods & techniques "Geophysical Survey"

Development type Research Project

Prompt Research

Position in the planning Not known / Not recorded

process

Solid geology (other) Wroxham Crag Formation Sand and Gravel

Drift geology GLACIAL SAND AND GRAVEL

Techniques Magnetometry

Project location

Country England

Site location NORFOLK BROADLAND AYLSHAM Land South of Cawston Road

Study area 2.00 Hectares

Site coordinates TG 1830 2592 52.7861589315 1.23766664575 52 47 10 N 001 14 15 E

Point

Height OD / Depth Min: 30.00m Max: 30.00m

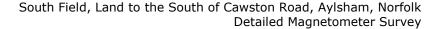
Project creators

Name of Organisation Britannia Archaeology Ltd

Project brief originator Self (i.e. landowner, developer, etc.)

Project design originator
Project director/ manager
Project supervisor
Type of sponsor/ funding
Timothy Schofield

body





Name of sponsor/ Mr Peter Purdy funding body

Project archives

Physical Archive Exists? No

Digital Archive recipient Norfolk Museums and Archaeology Service

Digital Contents "Survey

Digital Media available "Geophysics", "Images raster / digital photography", "Images vector",

"Survey", "Text"

Paper Archive recipient Norfolk Museums and Archaeology Service

Paper Contents "Survey"

Paper Media available "Report", "Survey ", "Unpublished Text"

Project bibliography 1

Publication type Grey literature (unpublished document/manuscript)

Title South Field, Land to the South of Cawston Road, Aylsham, Norfolk;

Detailed Magnetometer Survey

Author(s)/Editor(s) Schofield, T.P

Other bibliographic R1051

details

