Barrow WTW Resilience Scheme

Report on
Archaeological Geophysical Survey of Proposed Water Pipeline Route
2012

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Surveyed by:

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for:

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Introduction

This report describes the findings from a geophysical survey which forms part of an archaeological evaluation of the route of the route of the proposed Barrow WTW Resilience Scheme water pipeline in North Lincolnshire.

The geophysical survey was commissioned from Bartlett Clark Consultancy (BCC), Specialists in Archaeogeophysics of Oxford, by Cambridge Archaeological Unit (CAU) on behalf of Anglian Water Services. The survey is intended to meet the requirements of the North Lincolnshire SMR geophysical survey brief.

The pipeline route is about 5km south of Barton-upon-Humber, and 4.2km in length. The new water main is to be laid within a 20m working width. This was surveyed along as much of the route as was accessible at the time of the fieldwork, which was done in the week of 8 September 2012. The survey produced only minimal findings, as has been notified to CAU. A more detailed account of the results is now included for the record in this report.

The Proposed Route

Location and Topography

The proposed route is in two sections, which extend about 1km to the east and 3km to the south from the existing covered reservoir at Burnham Beeches Farm (NG TA 046167). The route crosses minor roads and farm tracks, terminating to the south at NG TA 062143. The route crosses open undulating farmland at elevations between 50 and 60m OD in an area of chalk bedrock at the northern end of the Lincolnshire Wolds. Boulder clay is present nearby to the east, but the route itself may be mainly free of drift deposits.

Archaeological background

One previously identified nearby archaeological finding which has been notified to us is a series of linear cropmarks in the field north of the Burnham reservoir. These are listed in the County SMR (22423 – MLS22423), and may relate to an Iron Age settlement known to be in the area of the reservoir. The ditches are to the north of the proposed route, which otherwise appears not to be intersected by any known archaeological sites. The main purpose of the survey was therefore to test for evidence of any previously unrecorded archaeological features.

We have also been asked to comment in this report on any strong ferrous magnetic anomalies which may be detected by the survey in case any such findings could indicate unexploded WWII ordnance. The route has previously been the subject of an Explosive

Ordnance Threat Assessment by Bactec Limited. The report on this assessment [1] mentions that the wartime Elsham Wolds airfield is located about 600m to the south west from the southern end of the route, and there were also two nearby airfield decoy sites. These could have presented bombing targets, although it is mentioned in the report that there was only a low density of bombing in this agricultural area

Survey Methodology

The procedure employed for the survey is based on recorded magnetometer coverage of a 20m wide strip along the route. This method provides detailed direct evidence for the presence of any detectable archaeological sites or features which intersect the route, and has been used successfully as part of the archaeological assessment process on numerous previous pipeline projects. A full magnetometer survey of this kind meets the recommendations for linear geophysical investigation as set out in the revised English Heritage geophysical guidelines document (*Geophysical Survey in Archaeological Field Evaluation*, English Heritage, 2008), as well as the Institute of Field Archaeologists' Code of Conduct (2006).

Fieldwork Procedure

The survey was carried out using Bartington 1m fluxgate magnetometers, with readings plotted at 25cm intervals along transects 1m apart.

The survey was positioned in each field by reference to OS co-ordinates measured from the digital mapping supplied by the client, and located with a differential GPS system. The OS coordinates of detected features can be read directly from digital copies of the Autocad plans.

Presentation and reporting

The results are presented in sections as grey scale plots alongside corresponding interpretative plans in figures 2-5 (at 1:2000 scale), and as graphical or x-y trace plots at 1:1250 scale in figures 6-8. The graphical plots show the reading after minimal pre-processing (zero mean baseline correction and truncation of extreme values). We include these plots for comparison with the grey scale presentations, and because awareness of magnetic anomaly amplitudes and profiles is necessary in reaching a considered interpretation of the survey data. The narrow dipole anomalies which are characteristic of ferrous objects are also more readily identifiable in graphical than in grey scale plots. The grey scale plots have been subject to additional weak low pass filtering (not applied to the graphical plots) to control background noise levels.

Potentially significant features are indicated in the interpretation by coloured outlines, or broken lines. Broken lines are used to permit a simplified representation of complex features, or to represent features which are too fragmented to form a satisfactory outline.

Colour coding has been used to distinguish different effects. Magnetic anomalies of possible archaeological origin are outlined in red, and strong disturbances (which are likely

to be of recent origin) in brown. Small background magnetic anomalies which may be of natural origin are indicated in light brown. Possible cultivation effects are shown in green, and ferrous anomalies and pipes in blue.

Results

Fields along the route have been numbered (1-10) from north to south for identification in this report. Not all the fields could be surveyed. Field 1, where the route runs alongside the existing reservoir, was newly and heavily ploughed, and ground conditions were therefore unsuitable for a magnetometer survey. Part of field 2 and field 3 were obstructed by a potato crop, and field 9 was under wheat. Coverage along the remainder of the route amounted to 2.5km.

The survey was centred for most of its length on the proposed pipe alignment as notified to us by Anglian Water, but it was relocated in parts of fields 4 and 7 to follow an alternative line which was being pegged out on the ground at the time of the fieldwork. There are therefore discontinuities in the survey alignment at the boundaries of those fields.

Conditions on the chalk bedrock should generally be favourable for a magnetometer survey, as was indicated by measuring the magnetic susceptibility of soil from the site. This gave a (relatively high) reading of 28 (x 10^{-8} SI/kg), confirming that features cut into chalk and containing a silted topsoil fill should be readily detectable. Previous magnetometer surveys at locations with comparable ground conditions in Lincolnshire have responded well and provided clear evidence for the presence of archaeological features. The survey, even so, produced only very limited findings. These are commented on by fields from the north.

Field 2

Two magnetic anomalies of uncertain significance have been outlined in red in the interpretation in case they are of archaeological relevance, and are labelled A and B in figure 2. Anomaly A is a short ditch-like linear feature, but it is isolated and about 6m long, and could well be a natural hollow or gully. A pit-like feature at B is accompanied by a curving negative anomaly about 10m across (as marked by a broken red line). The negative feature could indicate a buried chalk bank, or a partly extant hollow, but its location at the edge of the survey makes it difficult to interpret. Findings otherwise are limited to disturbances near the reservoir and road (as outlined in brown), and linear markings which could be cultivation effects (green). These do not align with present boundaries and so could perhaps indicate slight natural variations in the depth of the chalk.

Field 4

Findings include ferrous and other disturbances near to boundaries, but otherwise are limited to possible cultivation effects (green), which here align with boundaries.

Fields 5-6

There are strong disturbances (at C) near the road at the north of field 5, and near the track at the south of field 6. Such effects often indicate a spread of hardcore inside a field entrance. One very isolated and doubtful small pit-like feature is indicated at D.

Field 7

The main findings are linear markings of varying width (green). The ground here slopes down to the north, and so the linear magnetic anomalies perhaps represent natural variations in the depth of topsoil caused by slippage or erosion on the slope.

Field 8

There are disturbances near to the northern boundary, and some linear markings across the field. These are more regular than in field 7, and so could perhaps be modern cultivation effects. A (doubtful and isolated) pit or ditch-like feature is indicated at E.

Field 10

A large pipe (F) was detected at the south of the field.

A note on ferrous magnetic anomalies

It is mentioned in the Bactec report [1] that WWII high explosive bombs typically weigh 50-500kg, of which about half was explosive. A buried ferrous object of 25-250kg would give rise to a conspicuous magnetic anomaly, potentially several metres in width, but no findings of this kind were detected. The strong magnetic anomalies seen in the survey (other than the pipe in field 10) are either disturbances near boundaries or field entrances, or narrow single dipoles representing small near-surface ferrous objects. (These would typically be horseshoes or random items from farm machinery, as are seen in all arable fields.)

Conclusions

Conditions here should be favourable for the magnetic detection of archaeological features, but only minimal findings were obtained. The magnetic anomaly at B in field 2 is difficult to categorise, but there are otherwise only a very few weak and isolated possible pit-like features (as indicated in red). The survey is intersected by various linear features (green). These could partly be natural, but may include cultivation effects. There are no findings which suggest the presence of large buried ferrous objects.

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01865 200864 10 October 2012

Fieldwork for this survey was carried out by R. Ainslie and S. Ainslie.

Reference

[1] Explosive Ordnance Threat Assessment in respect of Barrow WTW Resilience Scheme for Anglian Water Services. Report 3990TA by Bactec International Limited. 15 August 2012.

506000E

416000N

N

Field 1
Field 2
Field 3
Field 4
Field 5
Field 6
Field 7
Field 8
Field 9
Field 10

1
2
3
4
5

6.1
6.2
7.1
7.2
8.1
8.2

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0 1:10000 500m

initial route of proposed pipe

2 1:2000 survey plots (figures 2-5)

2 1:1250 survey plots (figures 6-8)

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Figure 1: Location of Magnetometer Survey (and figures 2-8)

Field 1

newly ploughed

Reservoir (covered)

Field 2

N

potatoes

Field 2

55.7m

Field 3

potatoes

Magnetometer survey

magnetic anomalies (archaeological ?)

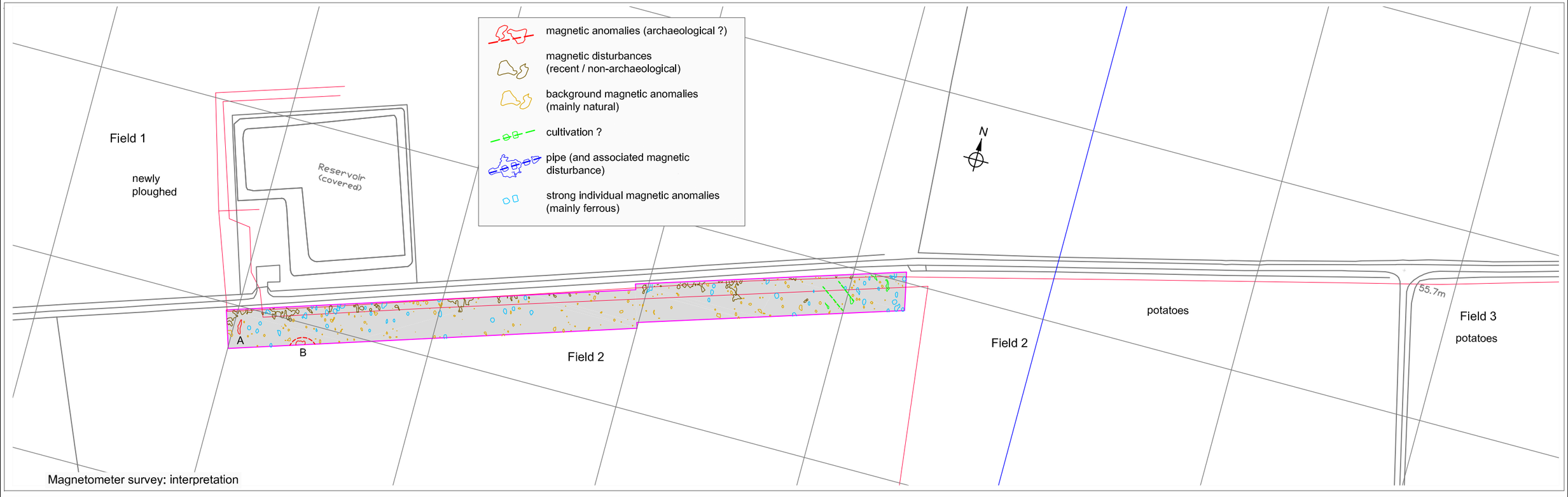
magnetic disturbances (recent / non-archaeological)

background magnetic anomalies (mainly natural)

cultivation ?

pipe (and associated magnetic disturbance)

strong individual magnetic anomalies (mainly ferrous)



Magnetometer survey: interpretation

Magnetometer survey:

-1.8 nT 1.6 nT

0 1:2000 100m

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Figure 2: Magnetometer Survey
(grey scale plot) with interpretation

Field 3
Field 4
Field 5
Field 6
Field 4
Field 5
N
Und
1.22m Ri

Magnetometer survey

magnetic anomalies (archaeological ?)
magnetic disturbances (recent / non-archaeological)
background magnetic anomalies (mainly natural)
cultivation ?
pipe (and associated magnetic disturbance)
strong individual magnetic anomalies (mainly ferrous)

C
D

Magnetometer survey: interpretation

Magnetometer survey:
-1.8 nT 1.6 nT

0 1:2000 100m

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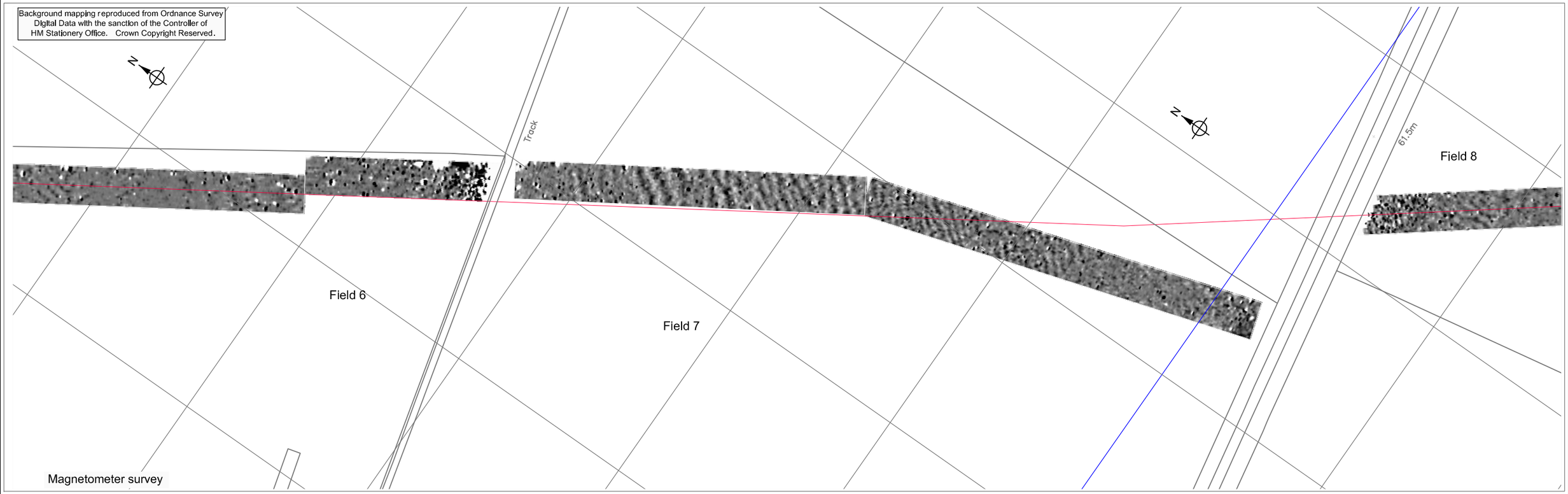
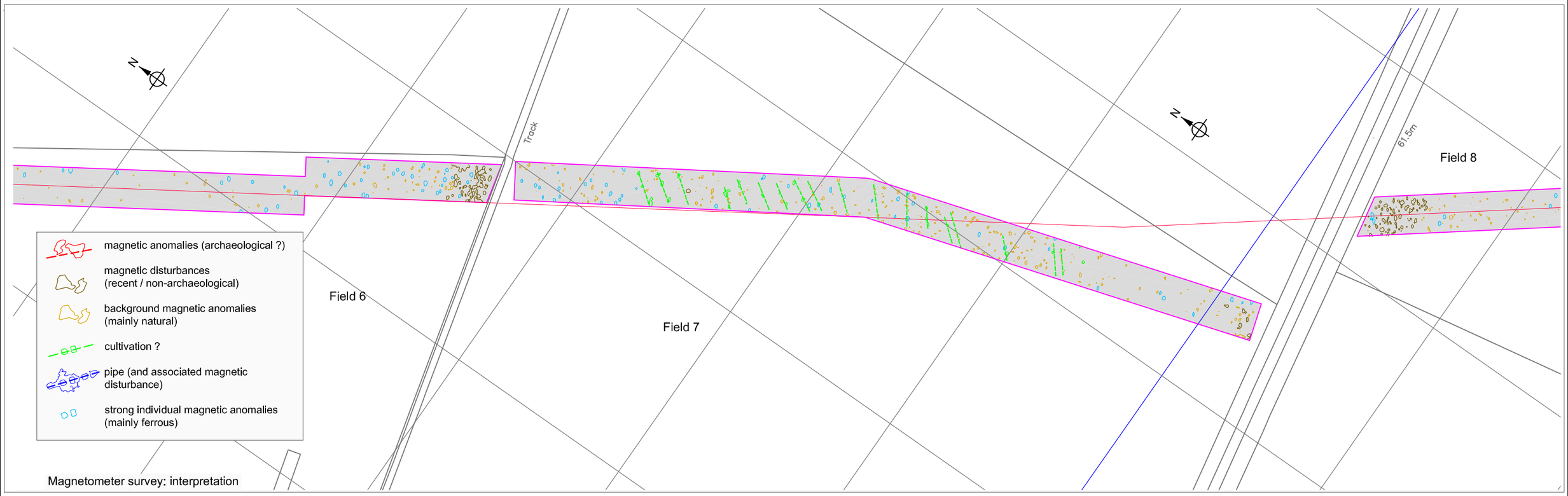
Figure 3: Magnetometer Survey
(grey scale plot) with interpretation

Magnetometer survey



Magnetometer survey: interpretation



Magnetometer survey:
-1.8 nT 1.6 nT

0 1:2000 100m

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Figure 4: Magnetometer Survey
(grey scale plot) with interpretation

N

Field 8

wheat

Field 9

Field 10

Magnetometer survey

magnetic anomalies (archaeological ?)

magnetic disturbances (recent / non-archaeological)

background magnetic anomalies (mainly natural)

cultivation ?

pipe (and associated magnetic disturbance)

strong individual magnetic anomalies (mainly ferrous)

E

F

Magnetometer survey: interpretation

0 1:1250 50m

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Figure 5: Magnetometer Survey
(grey scale plot) with interpretation

Field 1

Reservoir (covered)

N

Field 2

Field 3

Field 4

Field 5

- magnetic anomalies (archaeological ?)
- magnetic disturbances (recent / non-archaeological)
- background magnetic anomalies (mainly natural)
- cultivation ?
- pipe (and associated magnetic disturbance)
- strong individual magnetic anomalies (mainly ferrous)

0 1:1250 50m

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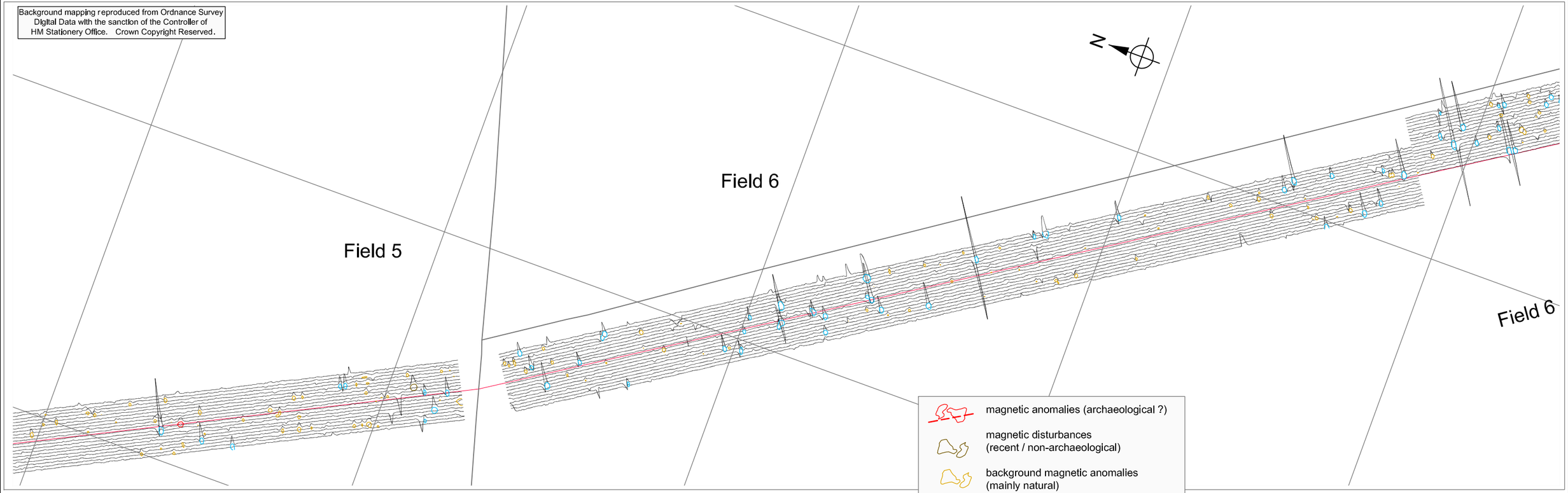
Thornton Curtis, North Lincolnshire
Archaeological Geophysical Survey 2012
Figures 6.1, 6.2: Magnetometer Survey
(with interpretation)



0 1:1250 50m

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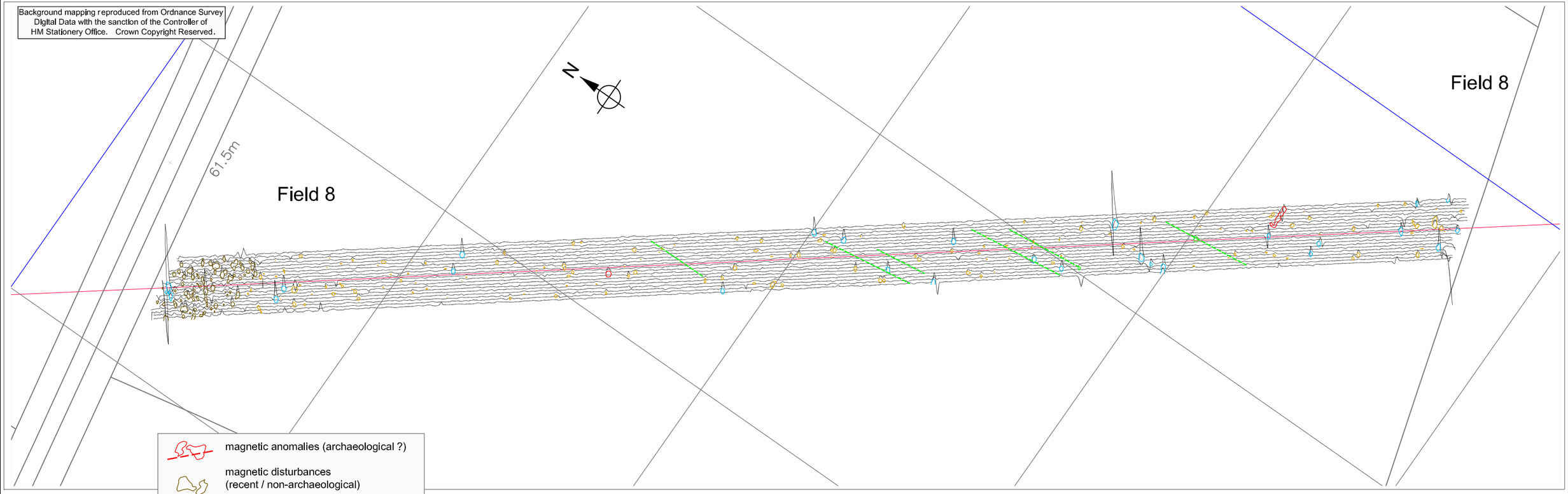
Archaeological Geophysical Survey 2012
Figures 7.1, 7.2: Magnetometer Survey
(with interpretation)



0 1:1250 50m

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Figures 8.1, 8.2: Magnetometer Survey (with interpretation)