STRATASCAN

Geophysical Survey Report

Newton-Le-Willows, Merseyside

for

Oxford Archaeology North

June 2007

J2324

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REGISTERED IFA ORGANISATION

Document Title:	**Geophysical Survey Report** **Newton-Le-Willows, Merseyside**
Client:	**Oxford Archaeology North**
Stratascan Job No:	**J2324**
Techniques:	**Magnetic Susceptibility, Detailed Magnetometry, Detailed Resistivity**
National Grid Ref:	**SJ 600 945**

Field Team:	**Sam Russell BSc. (Hons) Phil Henderson BA (Hons), Lynda O'Sullivan BA (Hons), John Cook BSc. (Hons)**
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SUMMARY OF RESULTS

The geophysical survey undertaken over 185ha of agricultural land at Newton-le-Willows, Merseyside has identified a number of anomalies of possible archaeological origin. Positive linear anomalies indicate the presence of cut features such as ditches and negative anomalies suggest the presence of possible former earthworks or banks. Discrete positive anomalies have been interpreted as possible pits. The resistivity data undertaken over a section of Area 12 has little correlation with the results of the detailed magnetometry survey. However a former field boundary can be identified in both data sets.

1. INTRODUCTION

1.1. Background synopsis

Stratascan were commissioned by Oxford Archaeology North to undertake a geophysical survey of an area outlined for development.

1.2. Site location

The site is located either side of the M6 motorway at Newton-Le-Willows, Merseyside at OS ref: SJ 600945.

1.3. Description of site

The survey area consists of approximately 185ha of agricultural land currently used for both pasture and arable. The underlying geology is Permian and Triassic sandstones (British Geological Survey South Sheet, Fourth Edition Solid, 2001). The overlying soils include Salop soils which are a type of stagnogley soil described as slowly permeable seasonally waterlogged reddish fine loamy over clayey soils; and Bridgenorth soils which are a type of brown sand described as well drained sandy and coarse loamy soils over soft sandstone (Soil Survey of England and Wales, Sheet 3 Midland and Western England).

1.4. Site history and archaeological potential

No specific details were available to Stratascan.

1.5. Survey objectives

The objective of the survey was to locate any features of possible archaeological significance in order that they may be investigated prior to development.

1.6. Survey methods

The reconnaissance technique of magnetic susceptibility was employed over the whole of the survey area. From this a number of areas were targeted for detailed magnetometry. A targeted detailed resistivity survey was subsequently carried out based on the results of the magnetometry survey. More information regarding these techniques is included in the Methodology section below.

2. METHODOLOGY

2.1. Date of fieldwork

The fieldwork was carried out over 33 days from 10th April 2007. Weather conditions during the survey were varied.

2.2. Grid locations

The location of the survey grids has been plotted in Figure 1.

2.3. Description of techniques and equipment configurations

3.3.1 *Magnetic Susceptibility*

Alteration of iron minerals in topsoil through biological activity and burning can enhance the magnetic susceptibility (MS) of that soil. Measuring the MS of a soil can therefore give a measure of past human activity and can be used to target the more intensive and higher resolution techniques of Magnetometry and Resistivity. Measurements of MS were carried out using a field coil which provides a rapid scan and has the benefit of allowing "insitu" readings to be taken.

The equipment used on this contract was an MS2 Magnetic Susceptibility meter manufactured by Bartington Instruments Ltd. A field coil known as an MS2D was used to take field readings. This assessed the top 200mm or so of topsoil. To overcome the problem of ground contact all readings were taken 4 or 5 times and an average taken. All obvious localised "spikes" were ignored.

3.3.2 *Magnetometer*

Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.2 nanoTesla (nT) in an overall field strength of 48,000nT, can be accurately detected using an appropriate instrument.

The mapping of the anomaly in a systematic manner will allow an estimate of the type of material present beneath the surface. Strong magnetic anomalies will be generated by buried iron-based objects or by kilns or hearths. More subtle anomalies such as pits and ditches can be seen if they contain more humic material which is normally rich in magnetic iron oxides when compared with the subsoil.

To illustrate this point, the cutting and subsequent silting or backfilling of a ditch may result in a larger volume of weakly magnetic material being accumulated in the trench compared to the undisturbed subsoil. A weak magnetic anomaly should therefore appear in plan along the line of the ditch.

The magnetic survey was carried out using a dual sensor Grad601-2 Magnetic Gradiometer manufactured by Bartington Instruments Ltd. The Grad601-2 consists of two high stability fluxgate gradiometers suspended on a single frame. Each sensor has a 1m separation between the sensing elements increasing the sensitivity to small changes in the Earths magnetic field.

3.3.3 *Resistivity*

This method relies on the relative inability of soils (and objects within the soil) to conduct an electrical current which is passed through them. As resistivity is linked to moisture content, and therefore porosity, hard dense features such as rock will give a relatively high resistivity response, while features such as a ditch which retains moisture give a relatively low response.

The resistance meter used was an RM15 manufactured by Geoscan Research incorporating a mobile Twin Probe Array. The Twin Probes are separated by 0.5m and the associated remote probes were positioned approximately 15m outside the grid. The instrument uses an automatic data logger which permits the data to be recorded as the survey progresses for later downloading to a computer for processing and presentation.

Though the values being logged are actually resistances in ohms they are directly proportional to resistivity (ohm-metres) as the same probe configuration was used through-out.

2.4. Sampling interval, depth of scan, resolution and data capture

3.4.1 *Sampling interval*

Magnetic susceptibility
The magnetic susceptibility survey was carried out on a 20m grid with readings being taken at the node points.

Magnetometer
Readings were taken at 0.25m centres along traverses 1m apart. This equates to 3600 sampling points in a full 30m x 30m grid. All traverses are surveyed in a “parallel” rather than “zigzag” mode to avoid heading error.

Resistivity
Readings were taken at 1.0m centres along traverses 1.0m apart. This equates to 900 sampling points in a full 30m x 30 grid. All traverses were surveyed in a “zigzag” mode.

3.4.2 *Depth of scan and resolution*

Magnetic Susceptibility
The MS2D coil assesses the average MS of the soil within a hemisphere of radius 200mm. This equates to a volume of some $0.016m^3$ and maximum depth of 200mm. As readings are only at 20m centres this results in a very coarse resolution but adequate to pick up trends in MS variations.

Magnetometer
The Grad601-2 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. The collection of data at 0.5m centres provides an appropriate methodology balancing cost and time with resolution.

Resistivity
The 0.5m probe spacing of a twin probe array has a typical depth of penetration of 0.5m to 1.0m. The collection of data at 1m centres with a 0.5m probe spacing provides an appropriate methodology balancing cost and time with resolution.

3.4.3 *Data capture*

Magnetic susceptibility
The readings are logged manually on site, and then transferred to the office where they are entered into a computer and colour scale *Surfer* plots are produced.

Magnetometer
The readings are logged consecutively into the data logger which in turn is daily down-loaded into a portable computer whilst on site. At the end of each job, data is transferred to the office for processing and presentation.

Resistivity
As with the magnetometer, readings are logged consecutively into the data logger which in turn is daily down- loaded into a portable computer whilst on site. At the end of each job, data is transferred to the office for processing and presentation.

2.5. Processing, presentation of results and interpretation

3.5.1 *Processing*

Magnetic susceptibility
No processing of the data has been undertaken.

Magnetometer
Processing is performed using specialist software known as *Geoplot 3.* This can emphasise various aspects contained within the data but which are often not easily seen in the raw data. Basic processing of the magnetic data involves 'flattening' the background levels with respect to adjacent traverses and adjacent grids. 'Despiking' is

also performed to remove the anomalies resulting from small iron objects often found on agricultural land. Once the basic processing has flattened the background it is then possible to carry out further processing which may include low pass filtering to reduce 'noise' in the data and hence emphasise the archaeological or man-made anomalies.

The following schedule shows the basic processing carried out on all processed magnetometer data used in this report:

Zero mean grid	*Threshold = 0.25 std. dev.*
Zero mean traverse	*Last mean square fit = off*
Despike	*X radius = 1 Y radius = 1*
	Threshold = 3 std. dev.
	Spike replacement = mean

Resistivity
The processing was carried out using specialist software known as *Geoplot 3* and involved the 'despiking' of high contact resistance readings and the passing of the data though a high pass filter. This has the effect of removing the larger variations in the data often associated with geological features. The net effect is aimed at enhancing the archaeological or man-made anomalies contained in the data.

The following schedule shows the processing carried out on the processed resistance plots.

Despike	*X radius = 1*
	Y radius = 1
	Spike replacement

3.5.2 Presentation of results and interpretation

Magnetic susceptibility
The presentation of the data for this site involves a colour scale plot of the field measurements overlain onto a site plan (see Figure 2).

Magnetometer
The presentation of the data for each site involves a print-out of the raw data both as grey scale (Figures 3, 8, 13, 18, 23, 28 and 33) and trace plots (Figures 4, 5, 9, 10, 14, 15, 19, 20, 24, 25, 29, 30, 34 and 35), together with a grey scale plot of the processed data (Figures 6, 11, 16, 21, 26, 31 and 36). Magnetic anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawing for the site (Figures 7, 12, 17, 22, 27, 32 and 37).

Resistivity
The presentation of the data for the site involves a print-out of the raw data as a grey scale plot (Figure 38), together with a grey scale plot of the processed data (Figure 39). Anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawing (Figure 40).

3. RESULTS

3.1. Magnetic Susceptibility

The reconnaissance technique of magnetic susceptibility was used over the entire 185ha of the site. The results showed that the fields to the east of the M6 had a generally higher magnetic susceptibility value than those to the west. This may be due to increased human activity or pedological variance. However, the Soil Survey of England and Wales shows no such change in geology (Soil Survey of England and Wales, Sheet 3 Midland and Western England).

Detailed gradiometry grids were targeted based on the results of the magnetic susceptibility survey.

3.2. Detailed Magnetometry

Detailed magnetometry was carried out over areas highlighted by the results of the magnetic susceptibility survey. Grids were positioned over areas of high susceptibility and areas of lesser enhancement in order to sample the area. However, a number of areas could not be surveyed due to access issues. These areas include: Area 2, Area 3, Area 4 and Area 16a.

A number of anomalies of possible archaeological origin have been identified and are outlined below.

Positive Linear and Area Anomalies

Positive linear and area anomalies have been identified in Areas 1, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15 and 16. These features represent cut features, such as ditches and may be of an archaeological origin. A rectilinear arrangement of cut features can be noted in the western limits of Area 12 and a smaller arrangement is evident in the central region of this area. Further investigation would be required in order to ascertain the nature of both of these features.

Positive curvilinear anomalies are evident in Areas 14 and 15. These anomalies may be related to prehistoric activity, however further investigation would be necessary to confirm this.

Positive linear anomalies related to agricultural activity such as ploughing are evident in many of the survey areas, as are anomalies that may be related to former field boundaries.

Negative Linear and Area Anomalies

Negative linear anomalies indicating the presence of former earthworks/banks have been identified in Areas 7, 10, 12, 13, 14, 15 and 16. A rectilinear arrangement of these anomalies in Area 7 may represent some form of enclosure in this part of the site. A negative curvilinear anomaly can be noted in the central region of Area 14. Negative linear anomalies in close proximity with positive linear anomalies suggesting some form of bank and ditch arrangement are evident in Areas 12, 13, 15 and 16.

Discrete Positive Anomalies

Discrete positive anomalies are evident in all the survey areas with the exception of Areas 6 and 8. These anomalies have been interpreted as possible pits and may be of an archaeological origin. The greatest concentration of these anomalies can be seen in Areas 10, 11, 12 and 15. Further investigation may be necessary in order to ascertain as to whether these anomalies are pits of an archaeological origin or natural features.

Magnetic Disturbance

Discrete areas of magnetic disturbance are evident in many of the survey areas. These anomalies represent some form of ground disturbance having taken place. A large discrete area of magnetic disturbance can be noted in Area 6. This anomaly has been interpreted as a thermoremnant feature of uncertain origin. The large numbers of areas of magnetic disturbance with values that may be attributed to thermoremnance may suggest some form of industrial activity or the dumping of industrial waste taking place on the site.

Large areas of magnetic variance can be noted in Areas 6, 7 and 8. The cause of this variance is unknown but may be related to changes in geology or pedology.

3.3. Detailed Resistivity

The data collected during the resistivity survey is dominated by high and low resistance linear anomalies representing agricultural activity such as ploughing. However high resistance linear and area anomalies have been identified which may relate to buried structural remains or compacted earth.

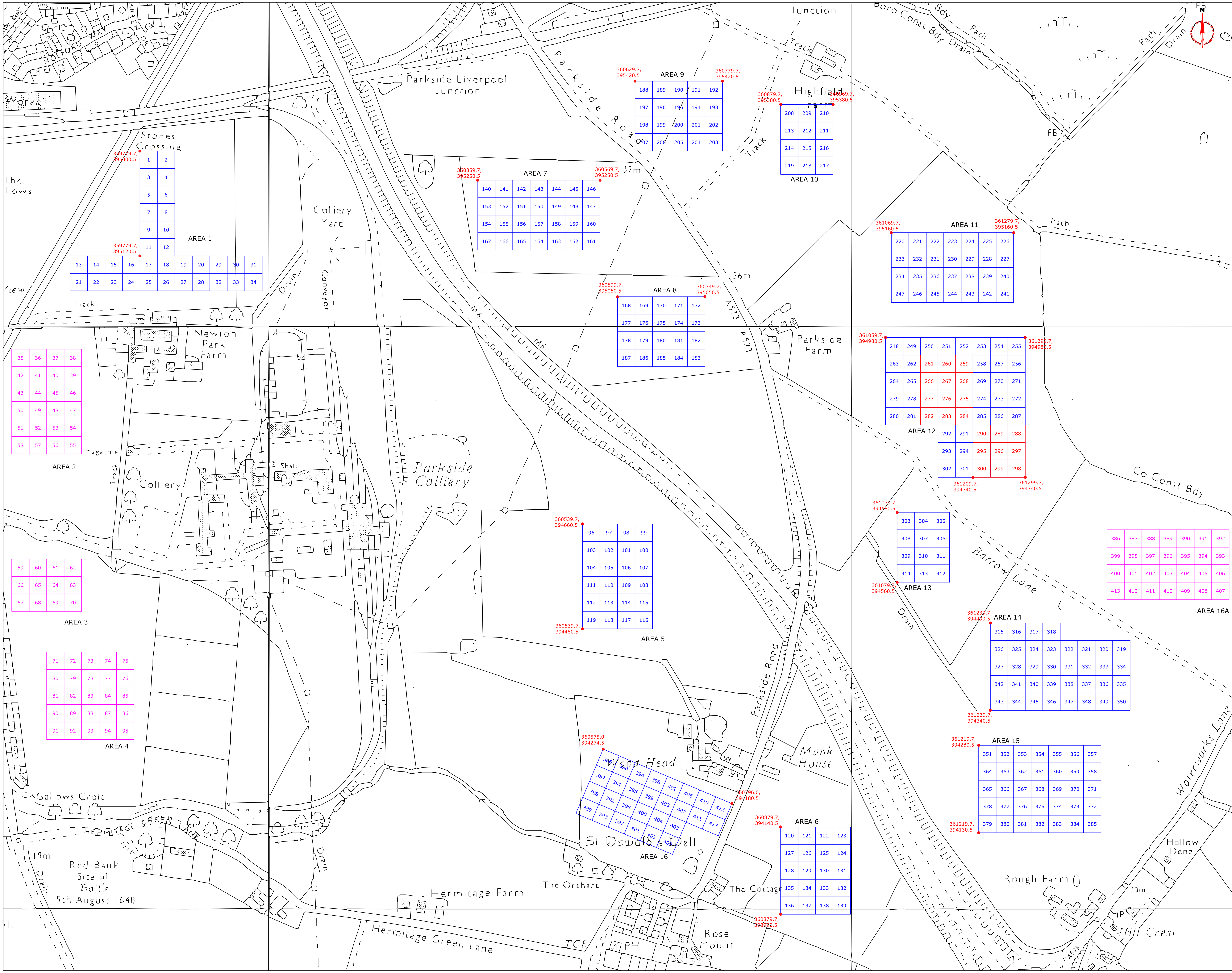
There is little correlation with the magnetometry data collected in this area. However, a possible former field boundary is evident in both the resistance and magnetometry data sets.

4. CONCLUSION

The geophysical survey undertaken at Newton-le-Willows, Merseyside has identified a number of anomalies of possible archaeological origin. Positive linear and area anomalies identified within the magnetometer data indicate the presence of cut features such as ditches. These features are evident within the majority of the survey areas however; particular concentrations can be noted in Areas 12, 13 and 15 which may suggest centres of activity in these areas.

A number of circular features have been noted within the magnetometer data in Areas 14 and 15. Further investigation may reveal these anomalies to be of an archaeological origin.

Discrete positive anomalies are evident across the site. These anomalies have been interpreted as possible pits, however the large number and spread of these features may suggest that they are of a geological origin. Further investigation would be required to ascertain the nature of these anomalies.



Amendments

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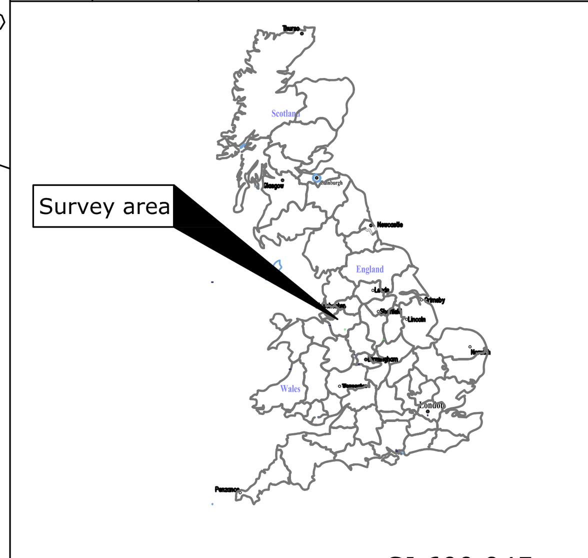

Site centred on NGR SJ 600 945

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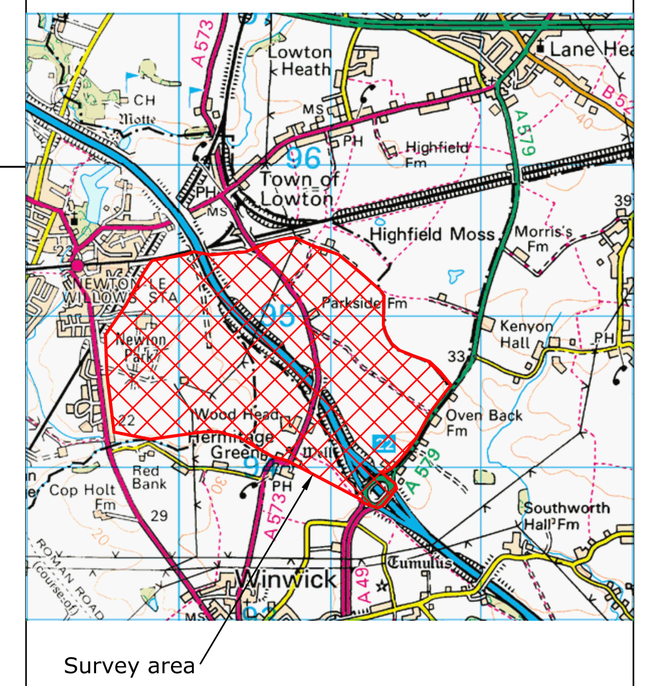
OS 100km square = SJ



Survey area

361299.7, 394740.5 National Grid Reference

Grids targeted with detailed gradiometry

Grids targeted with detailed gradiometry and resistivity

Areas unable to survey due to access issues

Job No.	Survey Date
2324	MAY 2007

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject

SITE LOCATION AND SURVEY AREA

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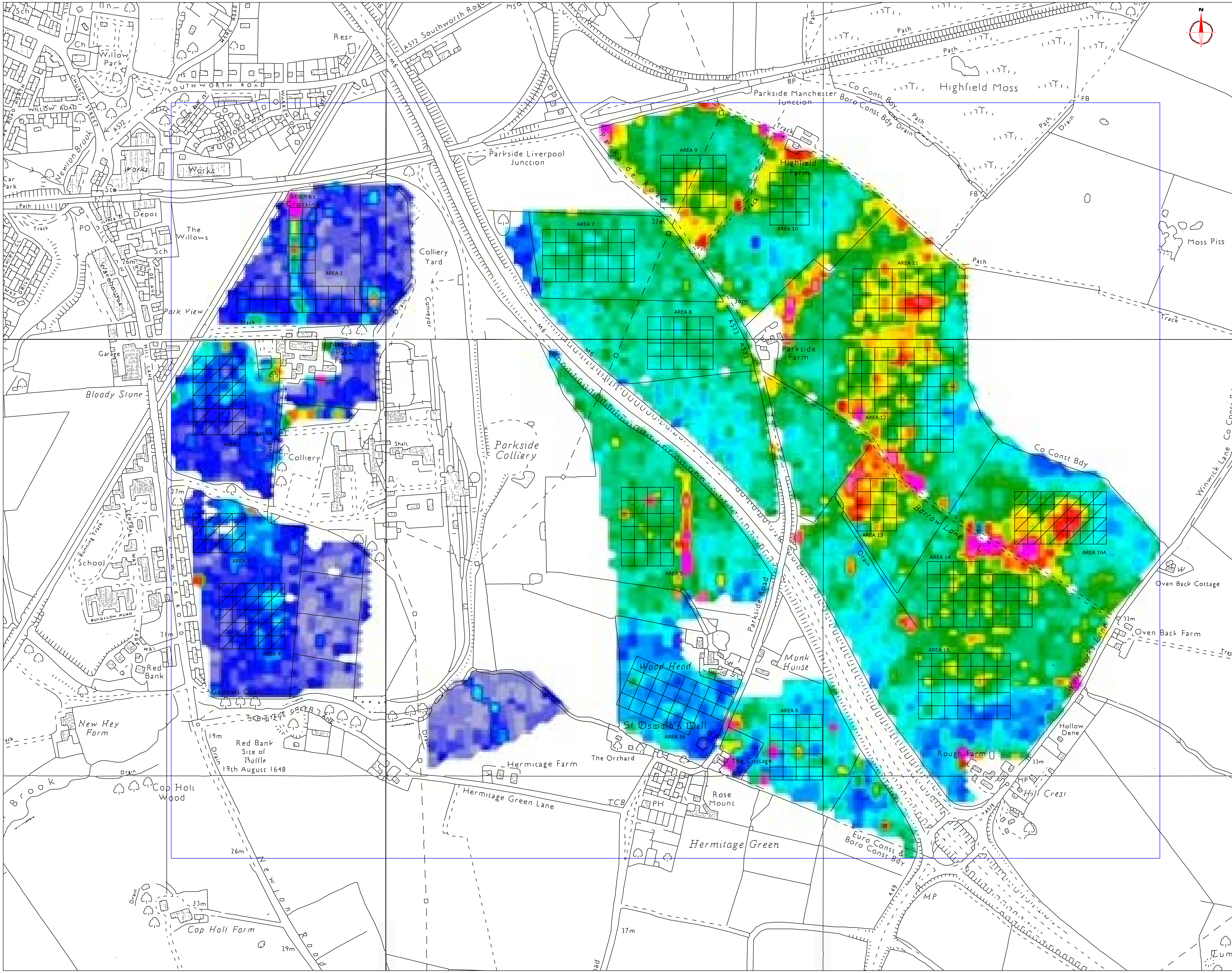
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	01



Grids targeted but not surveyed due to access issues

100

0

Plotting parameters
Maximum 100 10^{-8} SI (pink)
Minimum 0 10^{-8} SI (grey)

Amendments		
Issue No.	Date	Description
-	-	-

Job No. 2324

Survey Date MAY 07

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject

MAGNETIC SUSCEPTIBILITY
RESULTS

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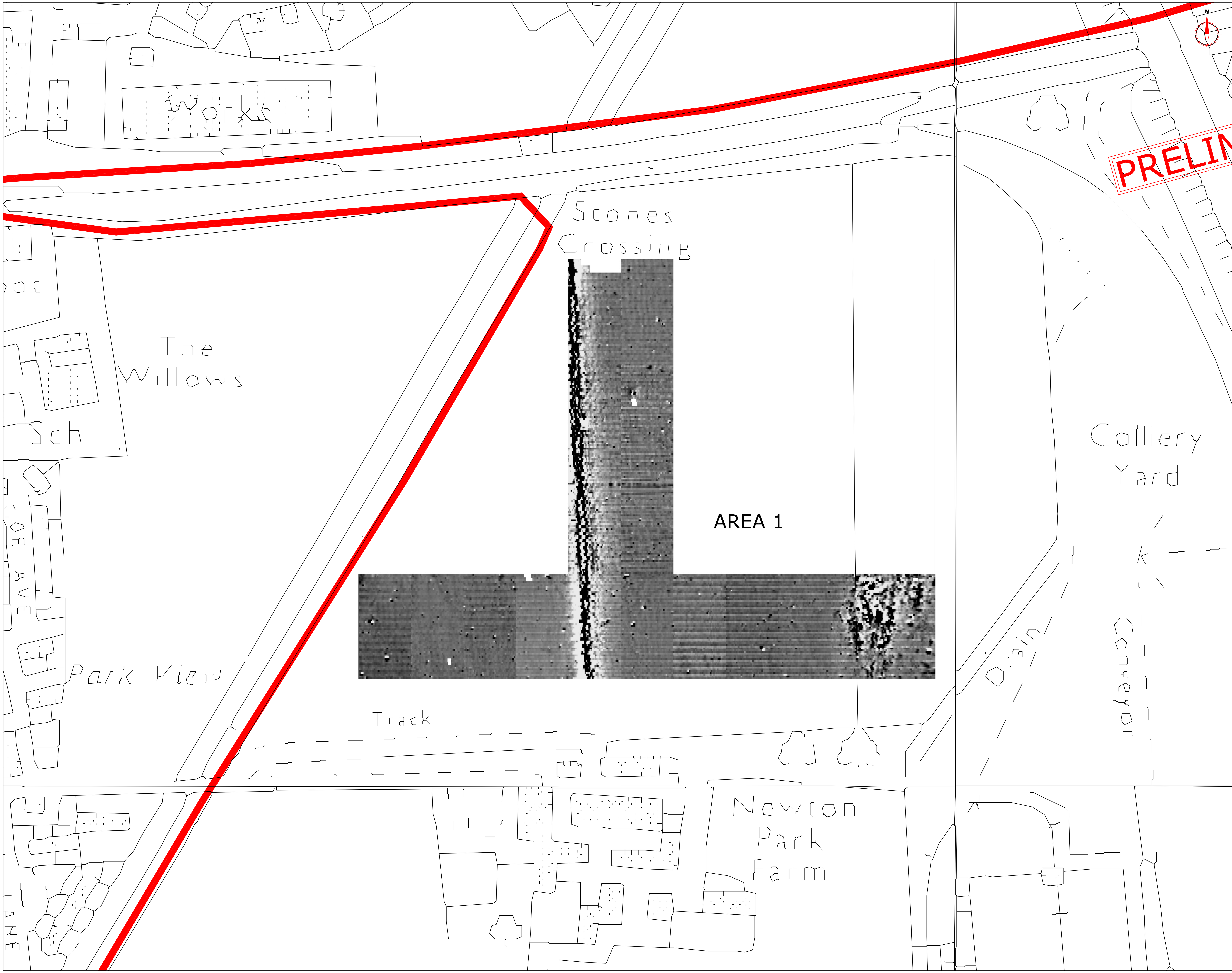
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	02



Amendments

Issue No.	Date	Description
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-	-	-

Plotting parameters

Maximum +5nT (black)
Minimum -5nT (white)

-3SD +3SD

+5nT
-5nT

Job No.	Survey Date
2324	MAY 2007

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject

PLOT OF RAW GRADIOMETER DATA

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Scale 1:1000 0m 10 20 30 40 50 60m

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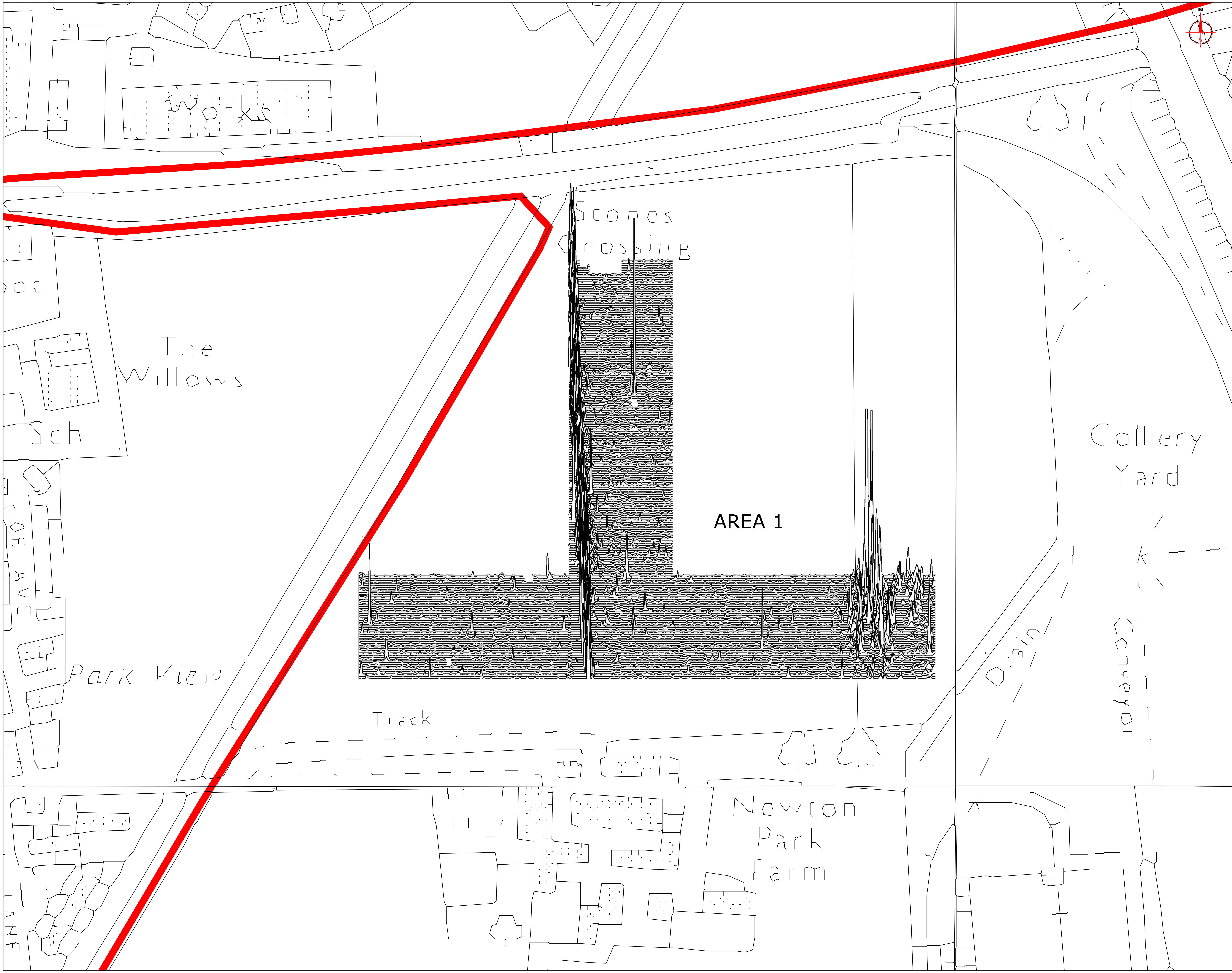
JUNE 07	RAJS	03



Amendments

Issue No.	Date	Description
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Plotting parameters

+40nT

(Positive values displace above the trace line. Hidden values have not been plotted)

200nT
160nT
120nT
80nT
40nT
0nT

Job No. 2324

Survey Date MAY 07

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY- NEWTON-LE-WILLOWS, MERSEYSIDE

Subject

TRACE PLOT SHOWING POSITIVE VALUES- AREA 1

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Scale 1:1000

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Date	**Drawn by**	**Figure No.**
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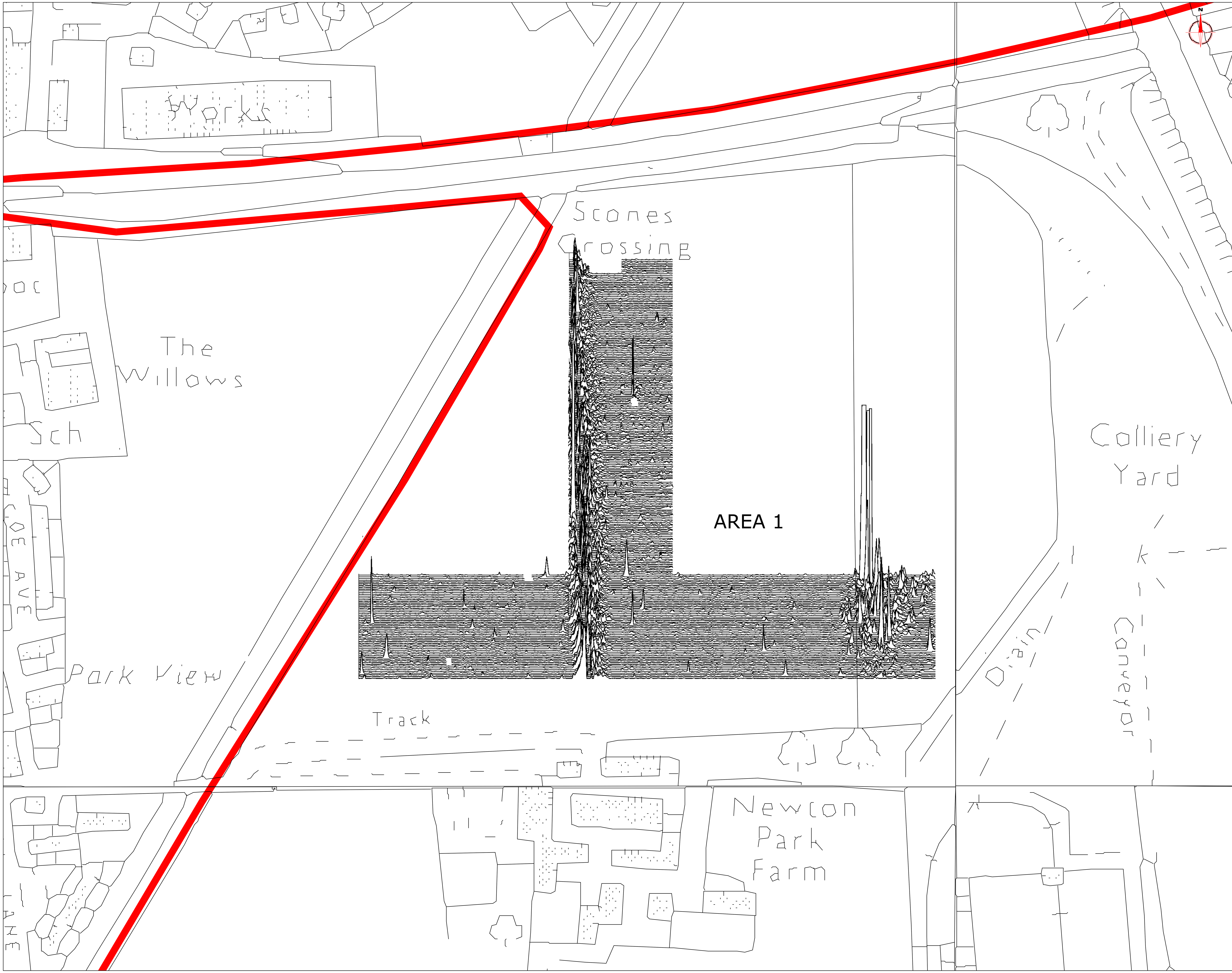

Amendments

Issue No.	Date	Description
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Plotting parameters

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-160nT
-120nT
-80nT
-40nT
0nT

Job No.	Survey Date
2324	MAY 07

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY- NEWTON-LE-WILLOWS, MERSEYSIDE

Subject

TRACE PLOT SHOWING NEGATIVE VALUES- AREA 1

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Scale 1:1000
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Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	05

Amendments

Issue No.	Date	Description
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-	-	-

Plotting parameters

Maximum +2nT (black)
Minimum -2nT (white)

-3SD +3SD

+2nT
-2nT

Job No.	Survey Date
2324	MAY 2007

Client
OXFORD ARCHAEOLOGY NORTH

Project Title
GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject
PLOT OF PROCESSED
GRADIOMETER DATA- AREA 1

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Scale 1:1000
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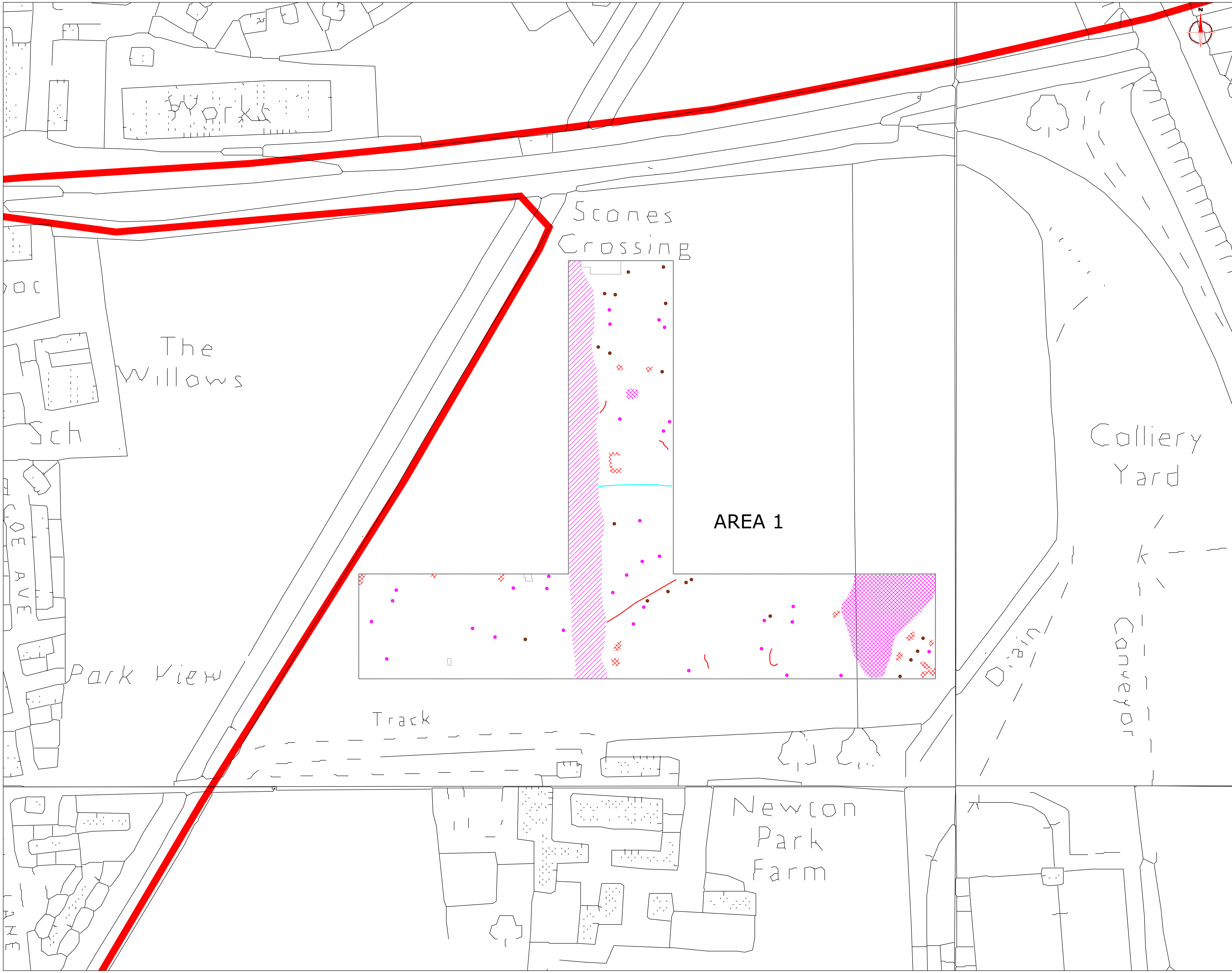

Amendments

Issue No.	Date	Description
-	-	-
		-

KEY

	Area of magnetic debris/disturbance- possibly related to pipe/cable
	Area of magnetic debris/disturbance
	Positive area anomaly- cut feature of possible archaeological origin
	Positive linear anomaly - cut feature of possible archaeological origin
	Linear anomaly- possibly related to land drain
	Discrete positive anomaly with negative response - ferrous object
	Discrete positive anomaly - possible pit

Job No. 2324

Survey Date MAY 07

Client
OXFORD ARCHAEOLOGY NORTH

Project Title
GEOPHYSICAL SURVEY- NEWTON-LE-WILLOWS, MERSEYSIDE

Subject
INTERPRETATION- AREA 1

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Scale 1:1000 (0m 10 20 30 40 50 60m)

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	07

Amendments

Issue No.	Date	Description
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-	-	-

Plotting parameters

Maximum +5nT (black)
Minimum -5nT (white)

-3SD +3SD

+5nT
-5nT

Job No.	Survey Date
2324	MAY 2007

Client
OXFORD ARCHAEOLOGY NORTH

Project Title
GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject
PLOT OF RAW GRADIOMETER
DATA- AREA 5

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Scale 1:1000 — 0m 10 20 30 40 50 60m

Plot	Checked by	Issue No.
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Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	08

Amendments		
Issue No.	Date	Description
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		-

Plotting parameters

+40nT

(Positive values displace above the trace line. Hidden values have not been plotted)

200nT
160nT
120nT
80nT
40nT
0nT

Job No.	Survey Date
2324	MAY 07

Client

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GEOPHYSICAL SURVEY-
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MERSEYSIDE

Subject

TRACE PLOT SHOWING POSITIVE VALUES- AREA 5

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Scale 1:1000 — 0m 10 20 30 40 50 60m

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	09

Amendments

Issue No.	Date	Description
-	-	-
		-

Plotting parameters

-40nT

(Negative values displace above the trace line. Hidden values have not been plotted)

-200nT
-160nT
-120nT
-80nT
-40nT
0nT

Job No.	Survey Date
2324	MAY 07

Client

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Project Title

GEOPHYSICAL SURVEY- NEWTON-LE-WILLOWS, MERSEYSIDE

Subject

TRACE PLOT SHOWING NEGATIVE VALUES- AREA 5

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Scale 1:1000 (0m 10 20 30 40 50 60m)

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	10

Amendments

Issue No.	Date	Description
-	-	-
-	-	-

Plotting parameters

Maximum +1nT (black)
Minimum -1nT (white)

-3SD +3SD

+1nT
-1nT

Job No.	Survey Date
2324	MAY 2007

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject

PLOT OF PROCESSED
GRADIOMETER DATA- AREA 5

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Scale 1:1000 (0m 10 20 30 40 50 60m)

Plot	Checked by	Issue No.
A1	PPB	01

Date	Drawn by	Figure No.
JUNE 07	RAJS	11

Amendments

Issue No.	Date	Description
-	-	-
		-

KEY

	Positive area anomaly- cut feature of possible archaeological origin
	Positive linear anomaly - cut feature of possible archaeological origin
	Agricultural mark
	Linear anomaly- possibly related to land drain
	Discrete positive anomaly with negative response - ferrous object
	Discrete positive anomaly - possible pit

Job No. 2324

Survey Date MAY 07

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY- NEWTON-LE-WILLOWS, MERSEYSIDE

Subject

INTERPRETATION- AREA 5

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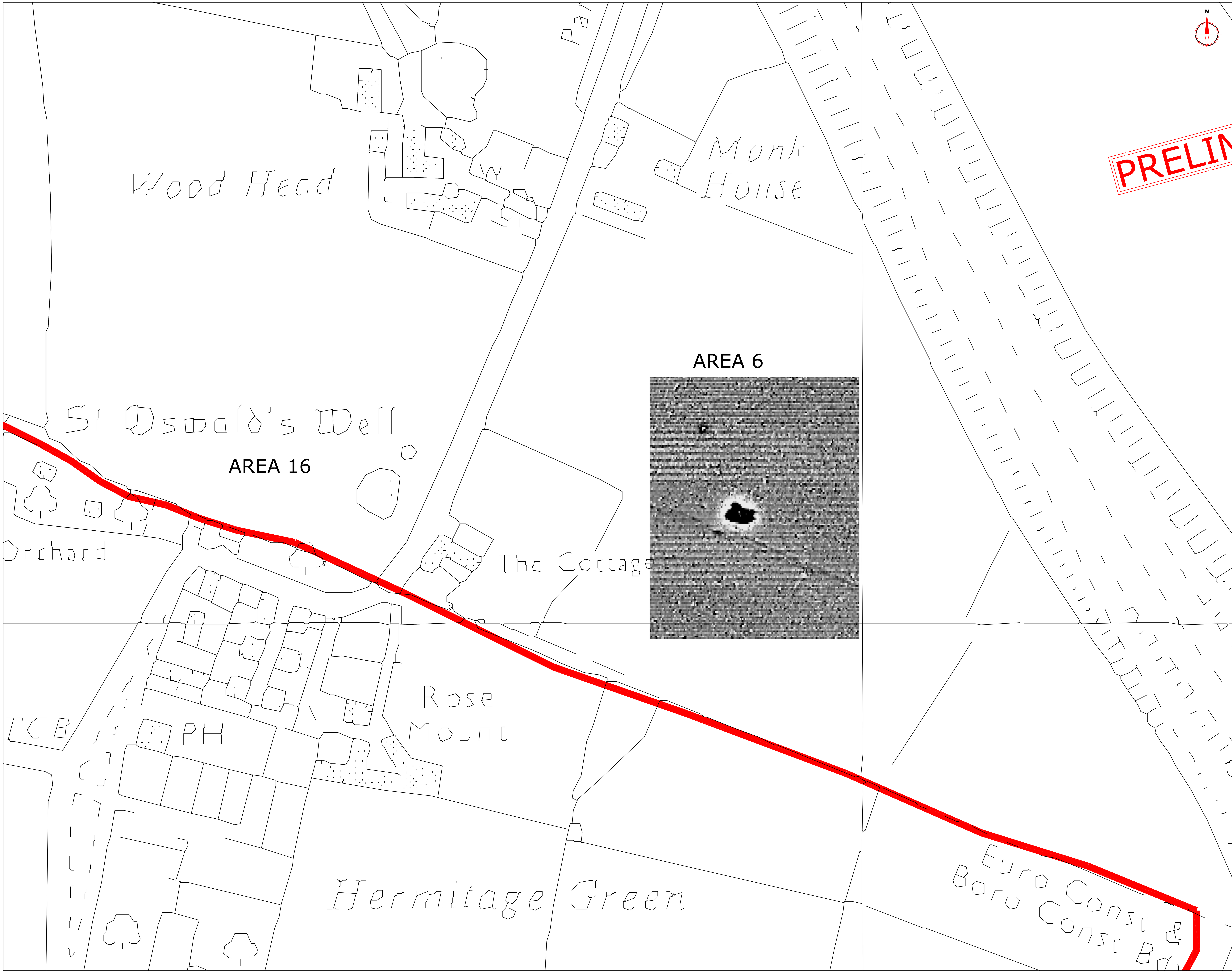
Scale 1:1000 (0m 10 20 30 40 50 60m)

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	12



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

Plotting parameters

Maximum +5nT (black)
Minimum -5nT (white)

-3SD +3SD

+5nT
-5nT

Job No. 2324	Survey Date MAY 2007

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject

PLOT OF RAW GRADIOMETER
DATA- AREA 6

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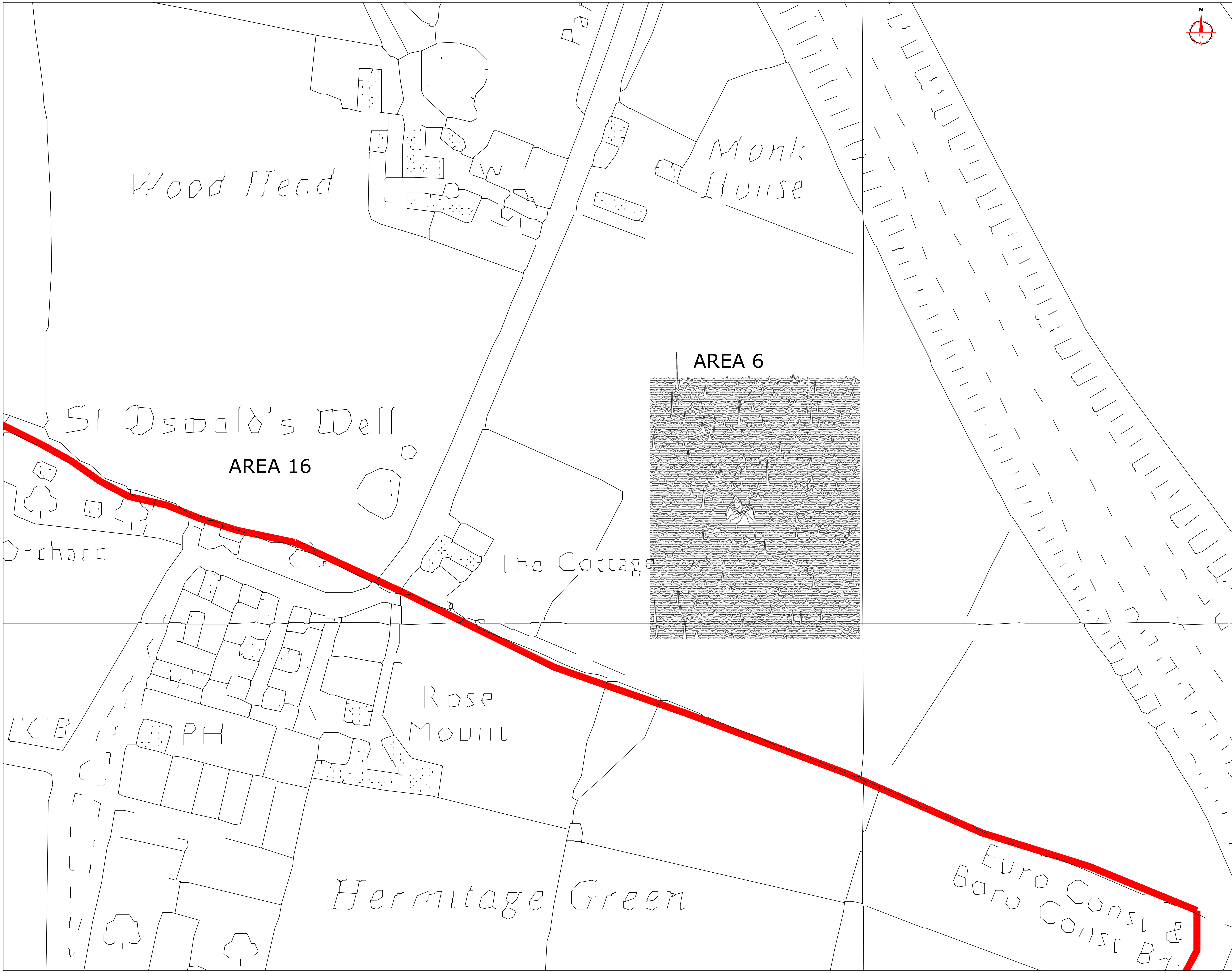
Scale
1:1000 0m 10 20 30 40 50 60m

Plot A1	Checked by PPB	Issue No. 01
Date JUNE 07	Drawn by RAJS	Figure No. 13



Amendments

Issue No.	Date	Description
-	-	-
		-

Plotting parameters

+40nT

(Positive values displace above the trace line. Hidden values have not been plotted)

200nT
160nT
120nT
80nT
40nT
0nT

Job No. 2324

Survey Date MAY 07

Client
OXFORD ARCHAEOLOGY NORTH

Project Title
GEOPHYSICAL SURVEY- NEWTON-LE-WILLOWS, MERSEYSIDE

Subject
TRACE PLOT SHOWING POSITIVE VALUES- AREA 6

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Scale 1:1000
0m 10 20 30 40 50 60m

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	14

Amendments

Issue No.	Date	Description
-	-	-
		-

Plotting parameters

-40nT

(Negative values displace above the trace line. Hidden values have not been plotted)

-200nT
-160nT
-120nT
-80nT
-40nT
0nT

Job No. 2324	Survey Date MAY 07

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY- NEWTON-LE-WILLOWS, MERSEYSIDE

Subject

TRACE PLOT SHOWING NEGATIVE VALUES- AREA 6

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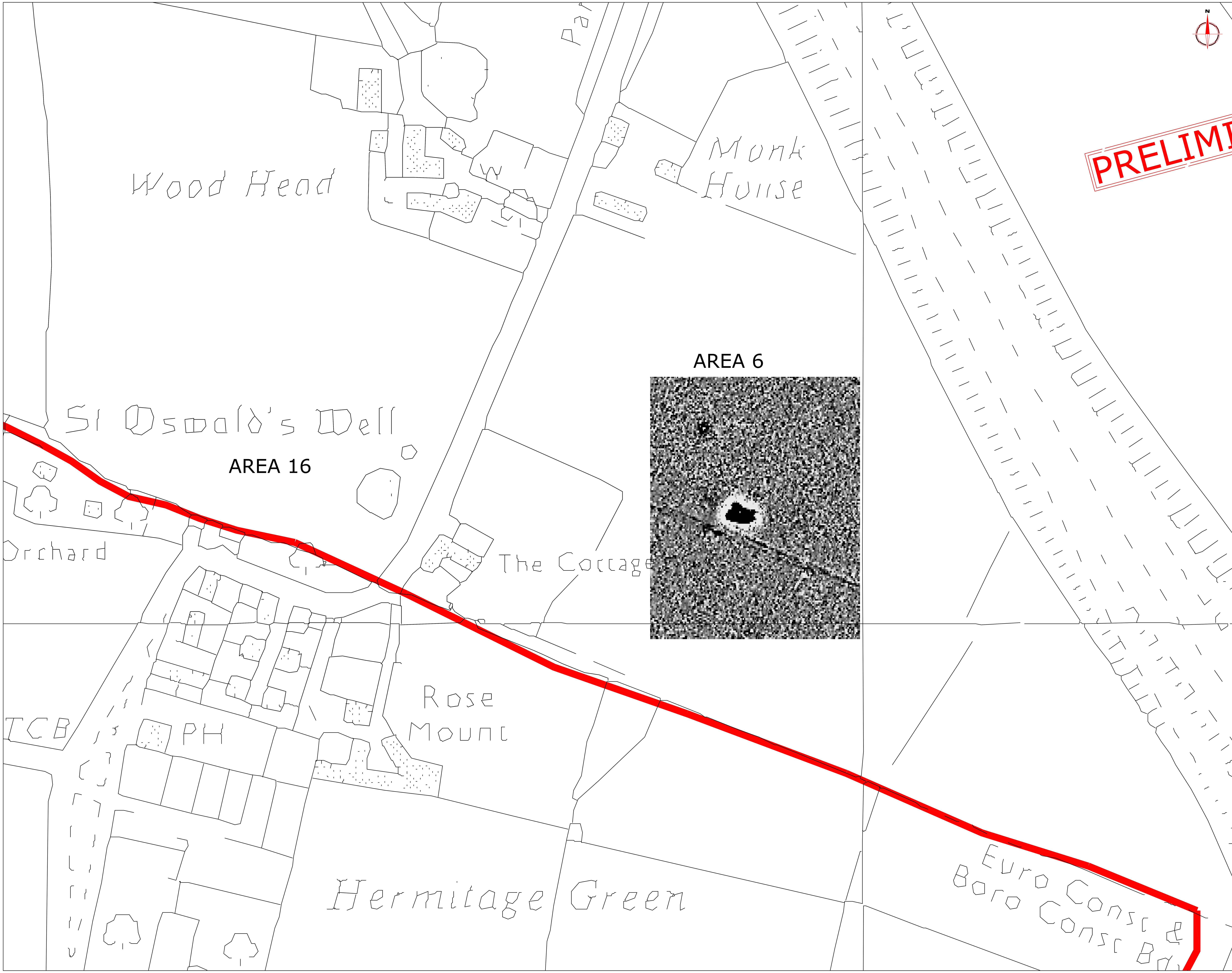
Scale 1:1000
0m 10 20 30 40 50 60m

Plot A1	Checked by PPB	Issue No. 01
Date JUNE 07	Drawn by RAJS	Figure No. 15



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

Plotting parameters

Maximum +2nT (black)
Minimum -2nT (white)

-3SD +3SD

+2nT
-2nT

Job No. 2324	Survey Date MAY 2007

Client
OXFORD ARCHAEOLOGY NORTH

Project Title
GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject
PLOT OF PROCESSED
GRADIOMETER DATA- AREA 6

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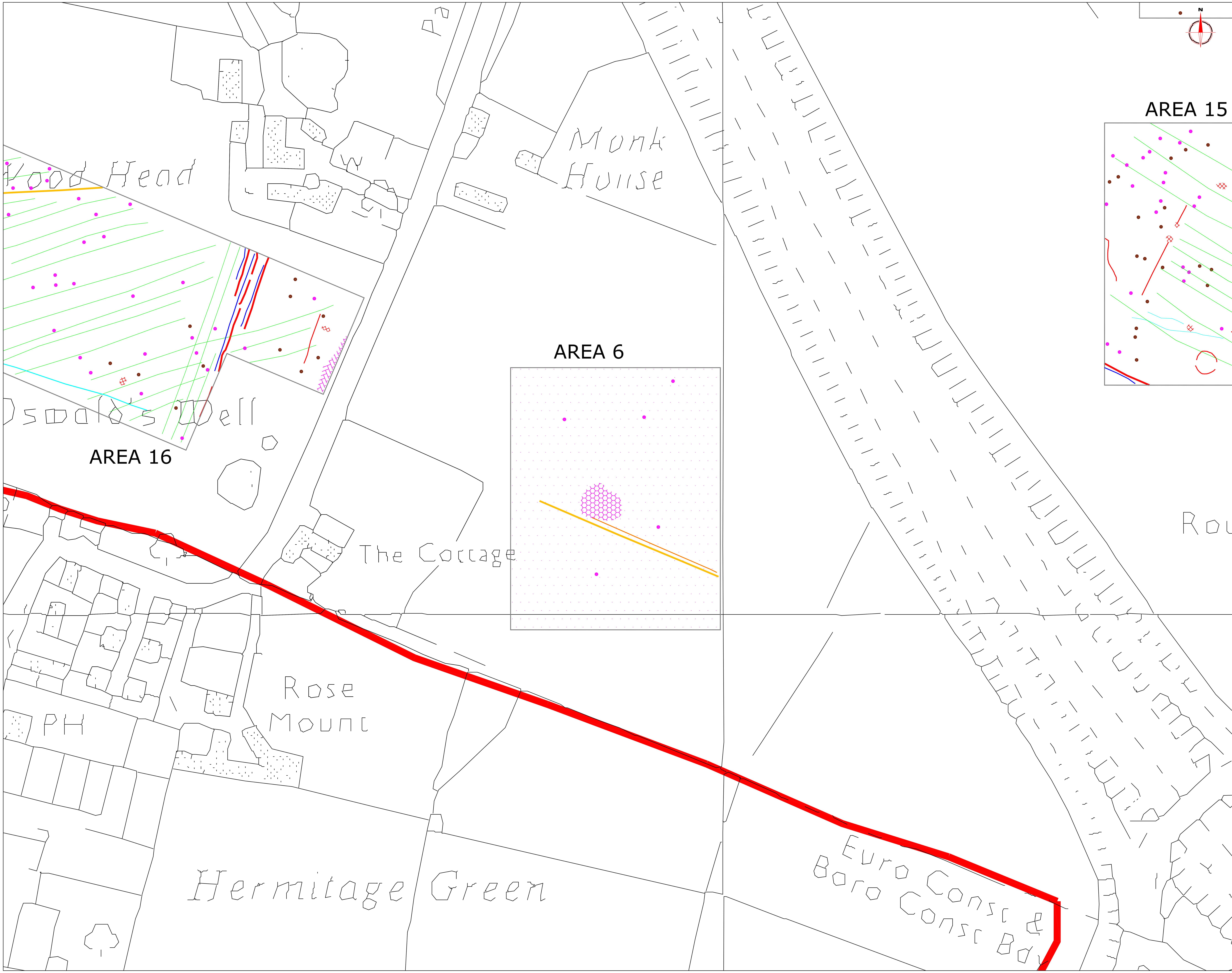
Scale 1:1000 — 0m 10 20 30 40 50 60m

Plot A1	Checked by PPB	Issue No. 01
Date JUNE 07	Drawn by RAJS	Figure No. 16



Amendments

Issue No.	Date	Description
-	-	-
		-

KEY

- Positive area anomaly- cut feature of possible archaeological origin
- Positive area anomaly with associated negative response- possible thermoremnant feature
- Positive linear anomaly- former field boundary
- Negative linear anomaly- former field boundary
- Discrete positive anomaly with negative response - ferrous object

Job No. 2324
Survey Date MAY 07

Client
OXFORD ARCHAEOLOGY NORTH

Project Title
GEOPHYSICAL SURVEY- NEWTON-LE-WILLOWS, MERSEYSIDE

Subject
INTERPRETATION- AREA 6

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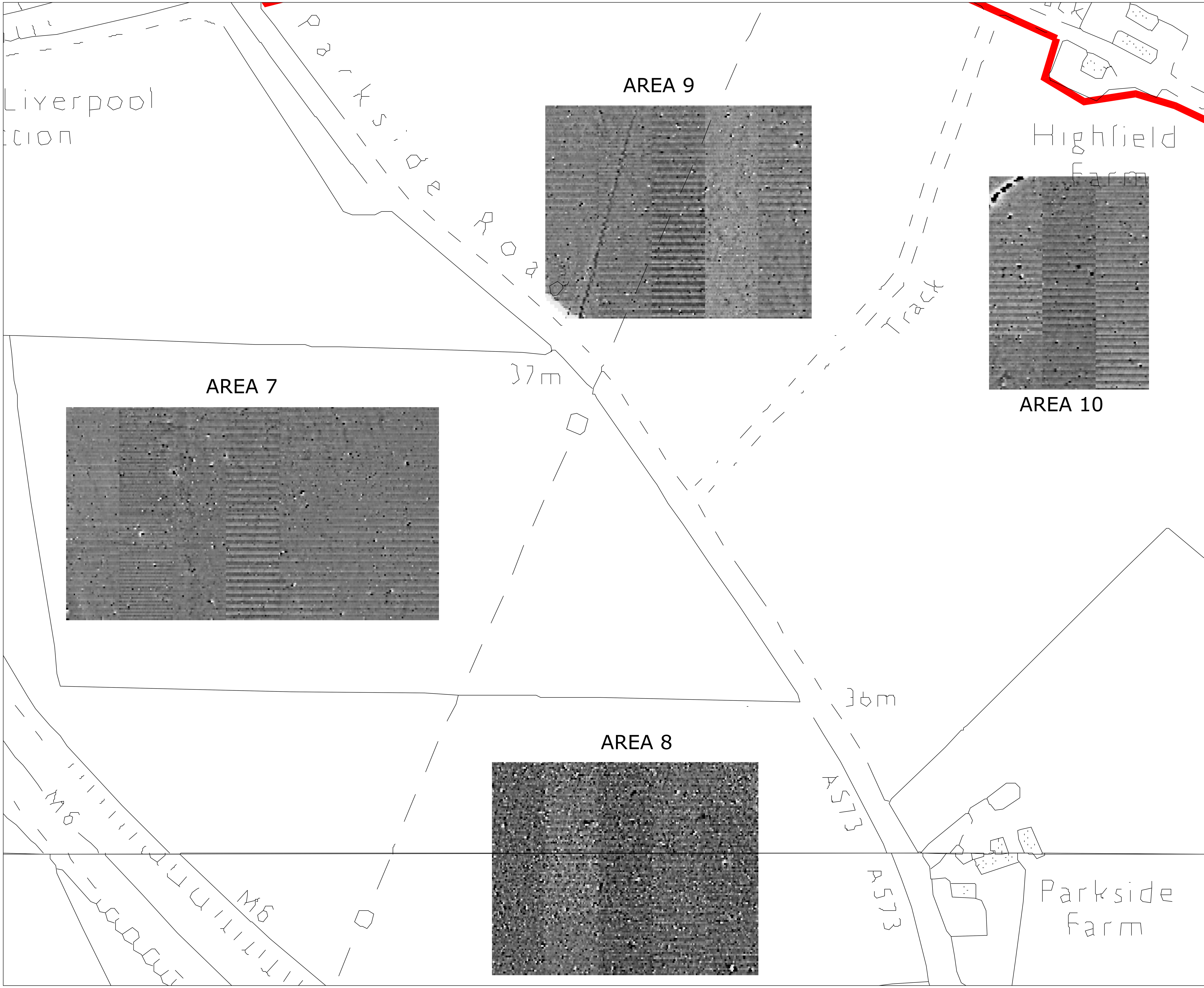
Scale 1:1000 (0m 10 20 30 40 50 60m)

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	17



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

Plotting parameters
Area 7
Maximum +5nT (black)
Minimum -5nT (white)
-3SD +3SD
+5nT -5nT

Plotting parameters
Area 8
Maximum +5nT (black)
Minimum -5nT (white)
-3SD +3SD
+5nT -5nT

Plotting parameters
Area 9
Maximum +5nT (black)
Minimum -5nT (white)
-3SD +3SD
+5nT -5nT

Plotting parameters
Area 10
Maximum +5nT (black)
Minimum -5nT (white)
-3SD +3SD
+5nT -5nT

Job No. 2324
Survey Date MAY 2007

Client
OXFORD ARCHAEOLOGY NORTH

Project Title
GEOPHYSICAL SURVEY- NEWTON-LE-WILLOWS, MERSEYSIDE

Subject
PLOT OF RAW GRADIOMETER DATA- AREAS 7 TO 10

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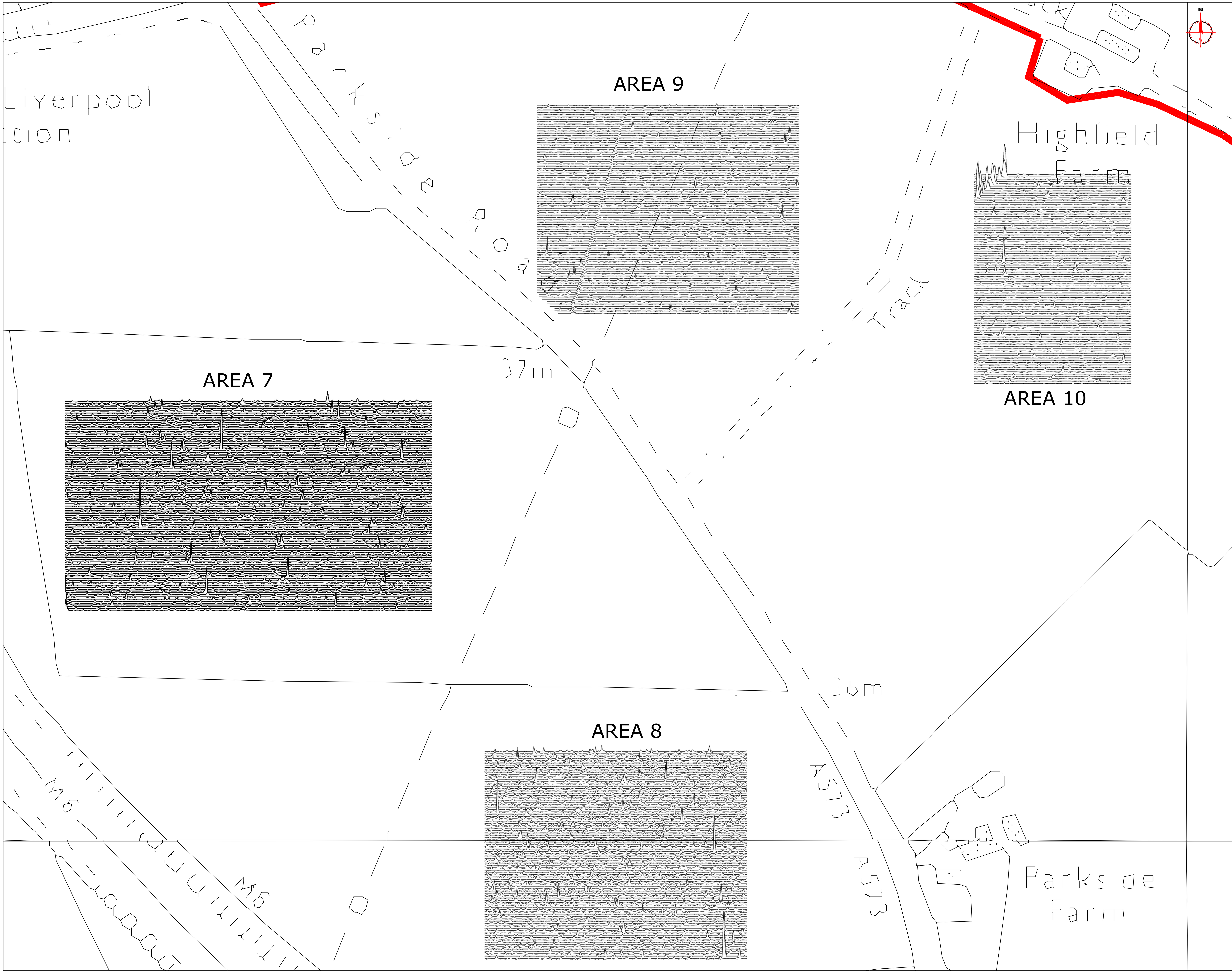
Scale 1:1000
0m 10 20 30 40 50 60m

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	18



Amendments

Issue No.	Date	Description
-	-	-
		-

Plotting parameters

+40nT

(*Positive values displace above the trace line. Hidden values have not been plotted*)

200nT
160nT
120nT
80nT
40nT
0nT

Job No.	Survey Date
2324	MAY 07

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY- NEWTON-LE-WILLOWS, MERSEYSIDE

Subject

TRACE PLOT SHOWING POSITIVE VALUES- AREAS 7-10

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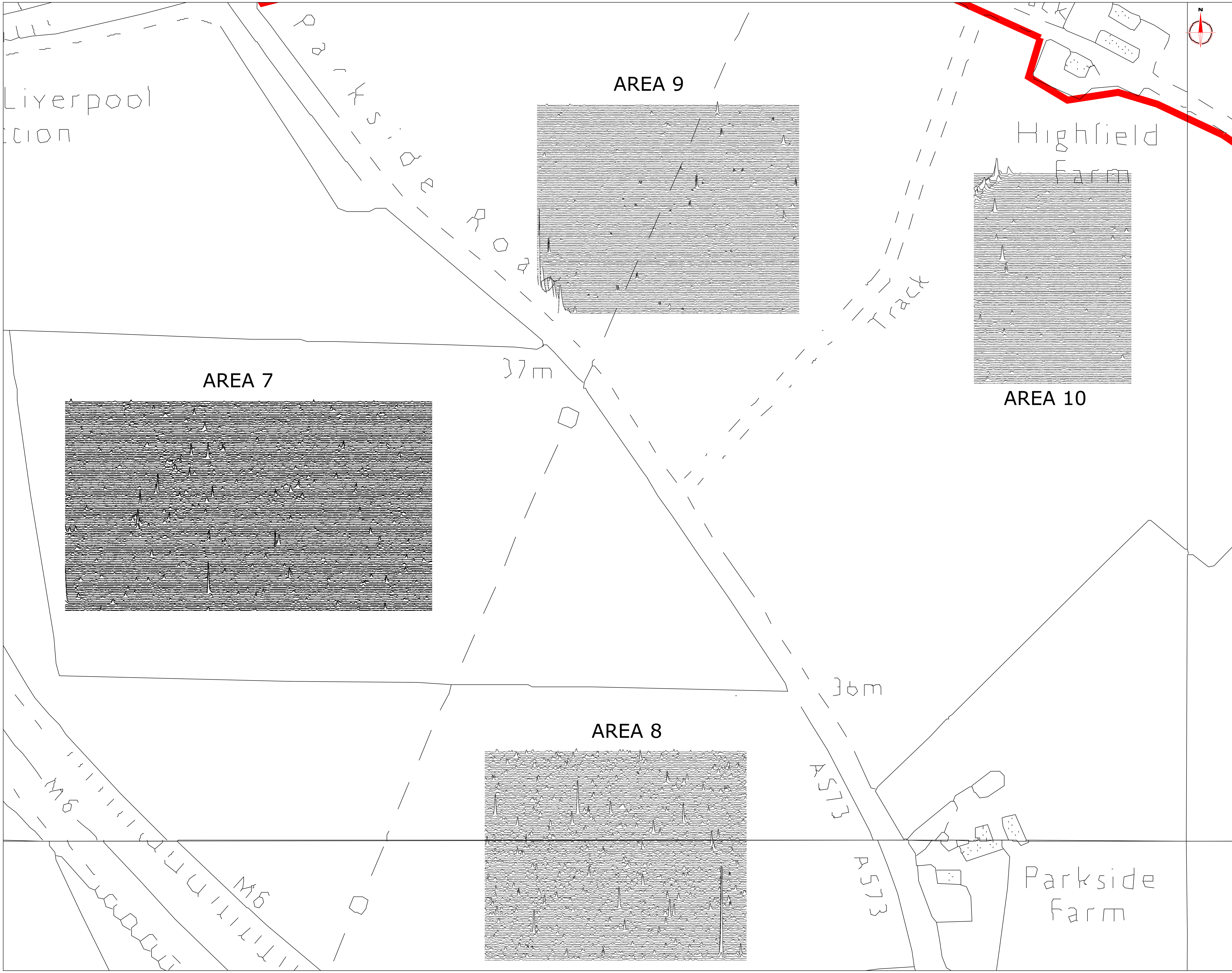
Scale 1:1000

0m 10 20 30 40 50 60m

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	19



Amendments		
Issue No.	Date	Description
-	-	-
		-

Plotting parameters

-40nT

(Negative values displace above the trace line. Hidden values have not been plotted)

-200nT
-160nT
-120nT
-80nT
-40nT
0nT

Job No. 2324	Survey Date MAY 07

Client
OXFORD ARCHAEOLOGY NORTH

Project Title
GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject
TRACE PLOT SHOWING NEGATIVE VALUES- AREAS 7-10

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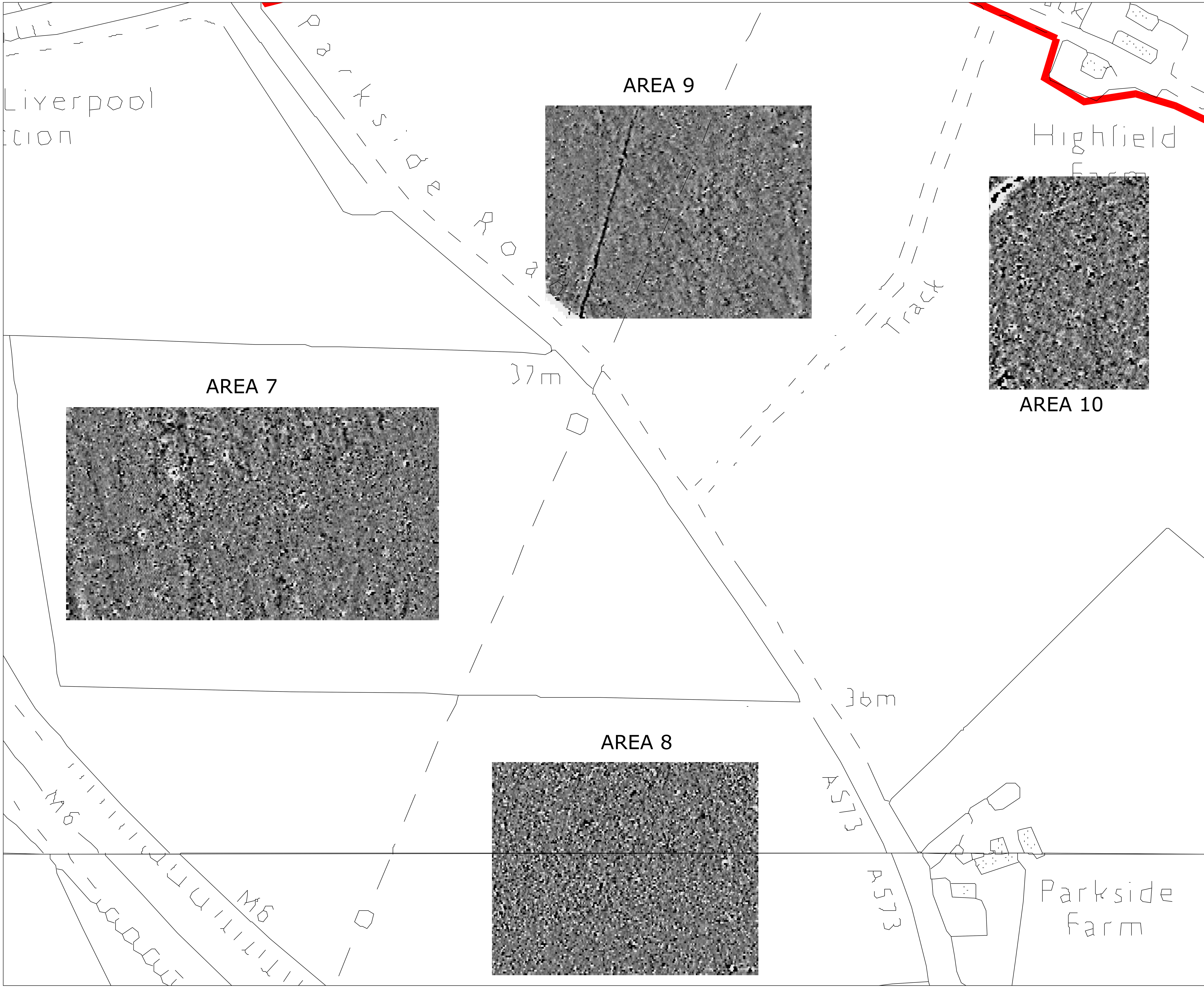
Scale 1:1000 — 0m 10 20 30 40 50 60m

Plot A1	Checked by PPB	Issue No. 01
Date JUNE 07	Drawn by RAJS	Figure No. 20



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

Plotting parameters
Area 7
Maximum +1nT (black)
Minimum -1nT (white)
-3SD +3SD
+1nT -1nT

Plotting parameters
Area 8
Maximum +3nT (black)
Minimum -3nT (white)
-3SD +3SD
+3nT -3nT

Plotting parameters
Area 9
Maximum +2nT (black)
Minimum -2nT (white)
-3SD +3SD
+2nT -2nT

Plotting parameters
Area 10
Maximum +1nT (black)
Minimum -1nT (white)
-3SD +3SD
+1nT -1nT

Job No. 2324
Survey Date MAY 2007

Client
OXFORD ARCHAEOLOGY NORTH

Project Title
GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject
PLOT OF PROCESSED
GRADIOMETER DATA-
AREAS 7 TO 10

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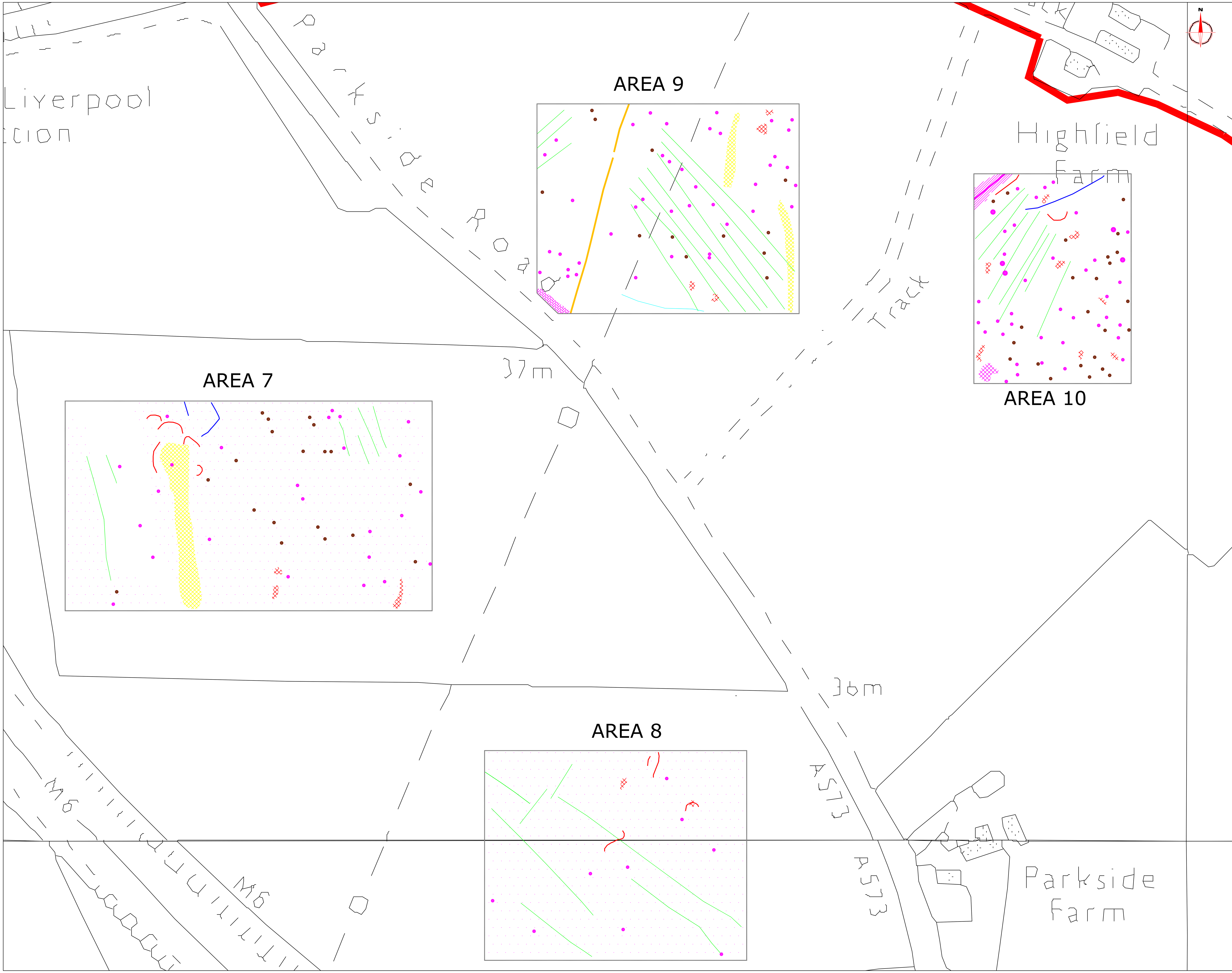
Scale 1:1000 0m 10 20 30 40 50 60m

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	21



Amendments

Issue No.	Date	Description
-	-	-
		-

KEY

	Positive area anomaly- cut feature of possible archaeological origin
	Positive area anomaly- cut feature of possible geological/pedological origin
	Magnetic debris of uncertain origin
	Magnetic disturbance
	Magnetic disturbance- associated with pipe/cable
	Magnetic disturbance- associated with fence
	Positive linear anomaly- possible archaeological origin
	Negative linear anomaly- possible former earthwork/bank
	Agricultural mark
	Possible former field boundary
	Discrete positive anomaly- possible pit
	Discrete positive anomaly with negative response - ferrous object

Job No. 2324

Survey Date MAY 07

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject

INTERPRETATION-
AREAS 7 TO 10

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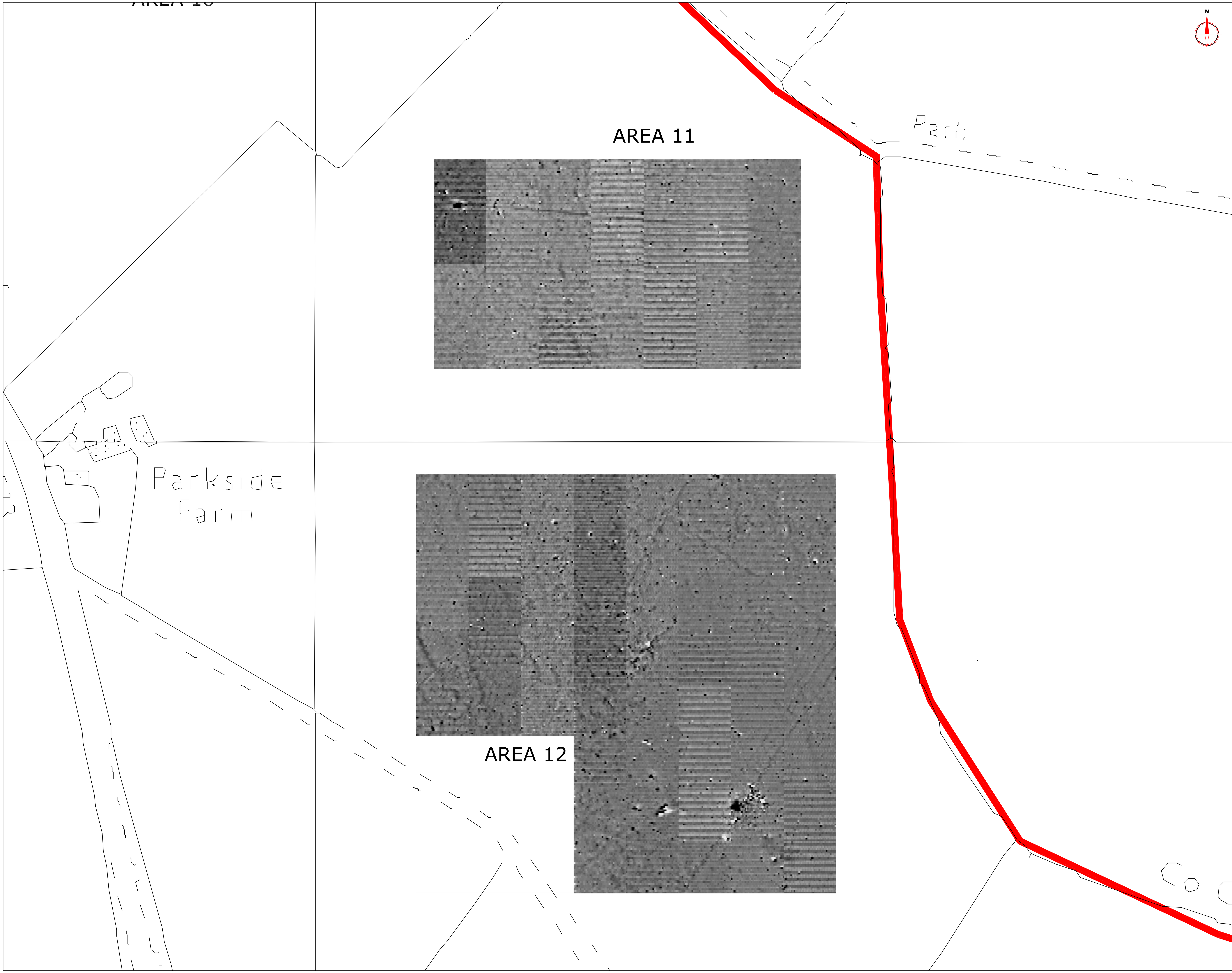
Scale 1:1000 — 0m 10 20 30 40 50 60m

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	22



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

Plotting parameters
Area 11
Maximum +5nT (black)
Minimum -5nT (white)

-3SD +3SD

+5nT
-5nT

Plotting parameters
Area 12
Maximum +5nT (black)
Minimum -5nT (white)

-3SD +3SD

+5nT
-5nT

Job No.	Survey Date
2324	MAY 2007

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject

PLOT OF RAW GRADIOMETER
DATA- AREAS 11 AND 12

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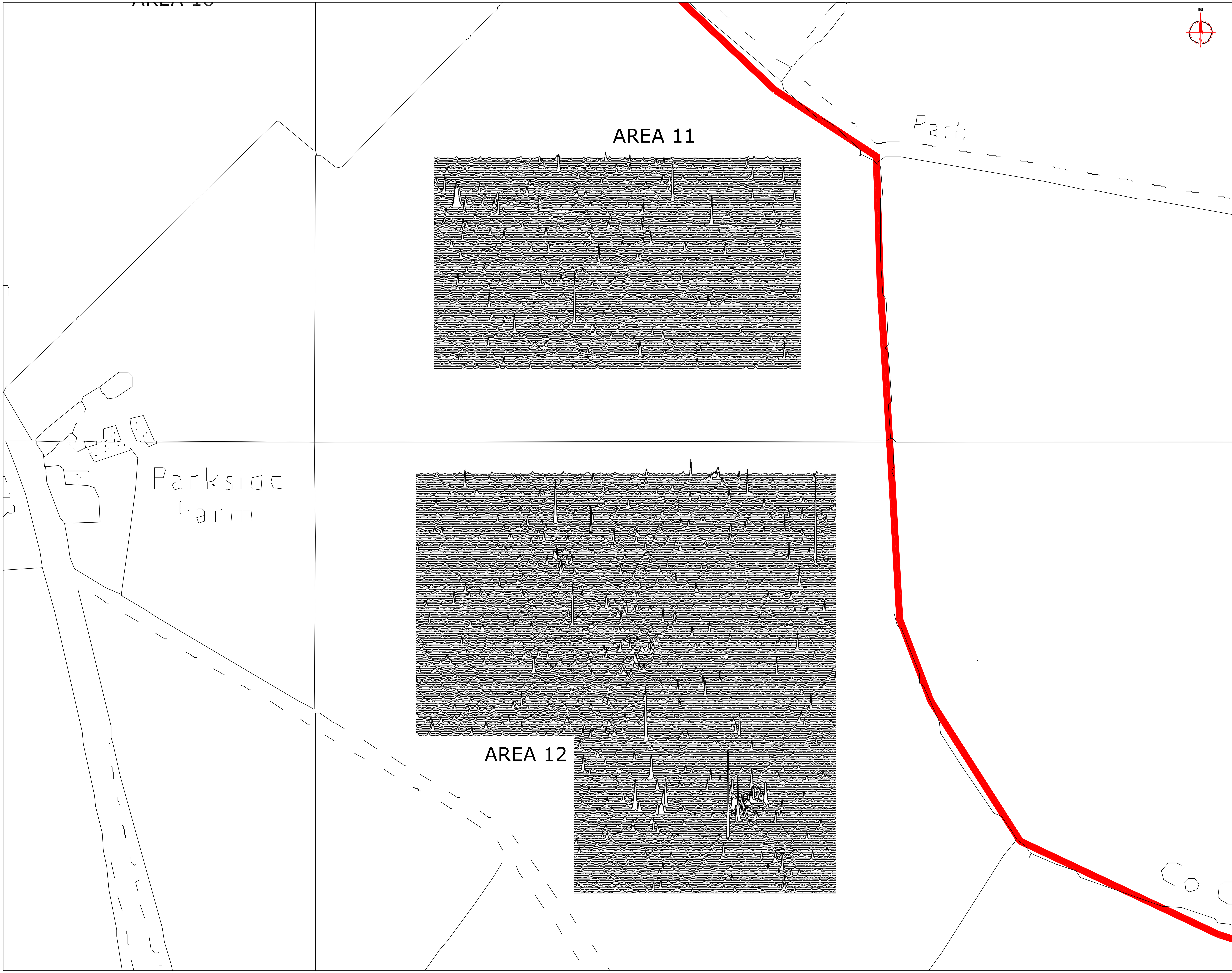
Scale
1:1000
0m 10 20 30 40 50 60m

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	23



Amendments

Issue No.	Date	Description
-	-	-
		-

Plotting parameters

+40nT

(Positive values displace above the trace line. Hidden values have not been plotted)

200nT
160nT
120nT
80nT
40nT
0nT

Job No.	Survey Date
2324	MAY 07

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY- NEWTON-LE-WILLOWS, MERSEYSIDE

Subject

TRACE PLOT SHOWING POSITIVE VALUES- AREAS 11-12

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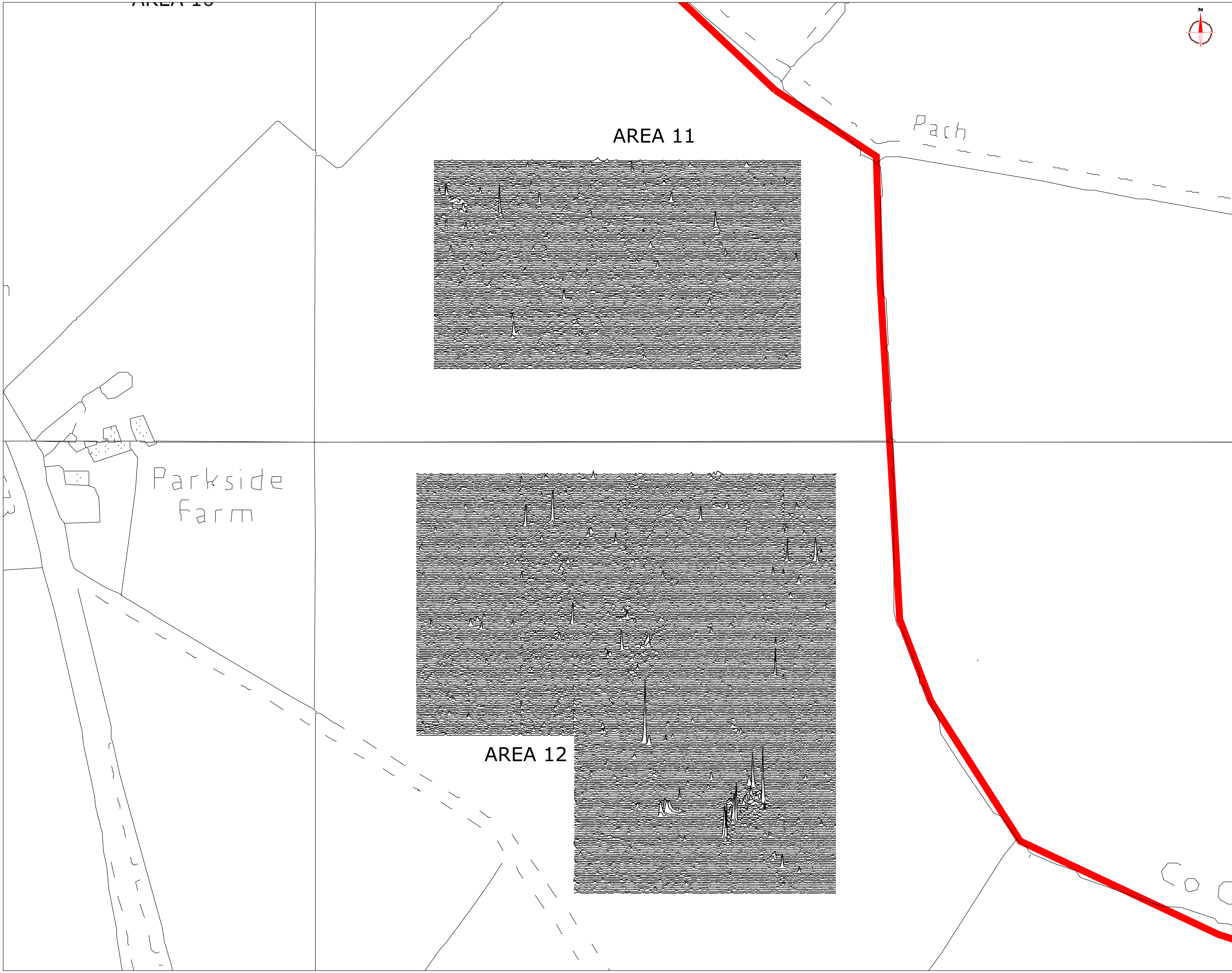
Scale 1:1000 — 0m 10 20 30 40 50 60m

Plot	Checked by	Issue No.
A1	PPB	01

Date	Drawn by	Figure No.
JUNE 07	RAJS	24



Amendments

Issue No.	Date	Description
-	-	-
		-

Plotting parameters

-40nT

(Negative values displace above the trace line. Hidden values have not been plotted)

-200nT
-160nT
-120nT
-80nT
-40nT
0nT

Job No. 2324

Survey Date MAY 07

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject

TRACE PLOT SHOWING NEGATIVE VALUES- AREAS 11-12

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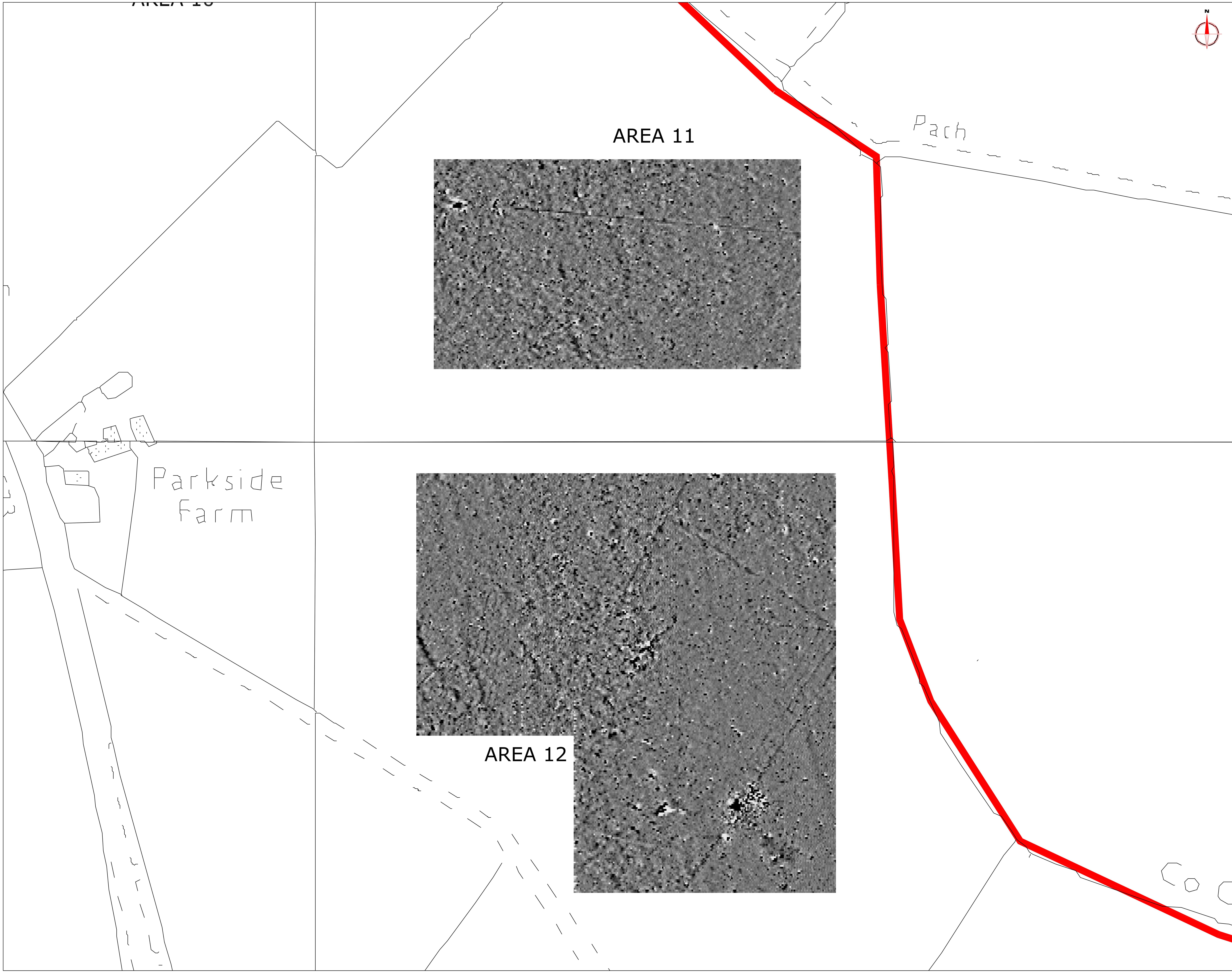
Scale 1:1000 — 0m 10 20 30 40 50 60m

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	25



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

Plotting parameters
Area 11
Maximum +2nT (black)
Minimum -2nT (white)

-3SD +3SD

+2nT
-2nT

Plotting parameters
Area 12
Maximum +2nT (black)
Minimum -2nT (white)

-3SD +3SD

+2nT
-2nT

Job No. 2324

Survey Date MAY 2007

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject

PLOT OF PROCESSED
GRADIOMETER DATA-
AREAS 10 AND 11

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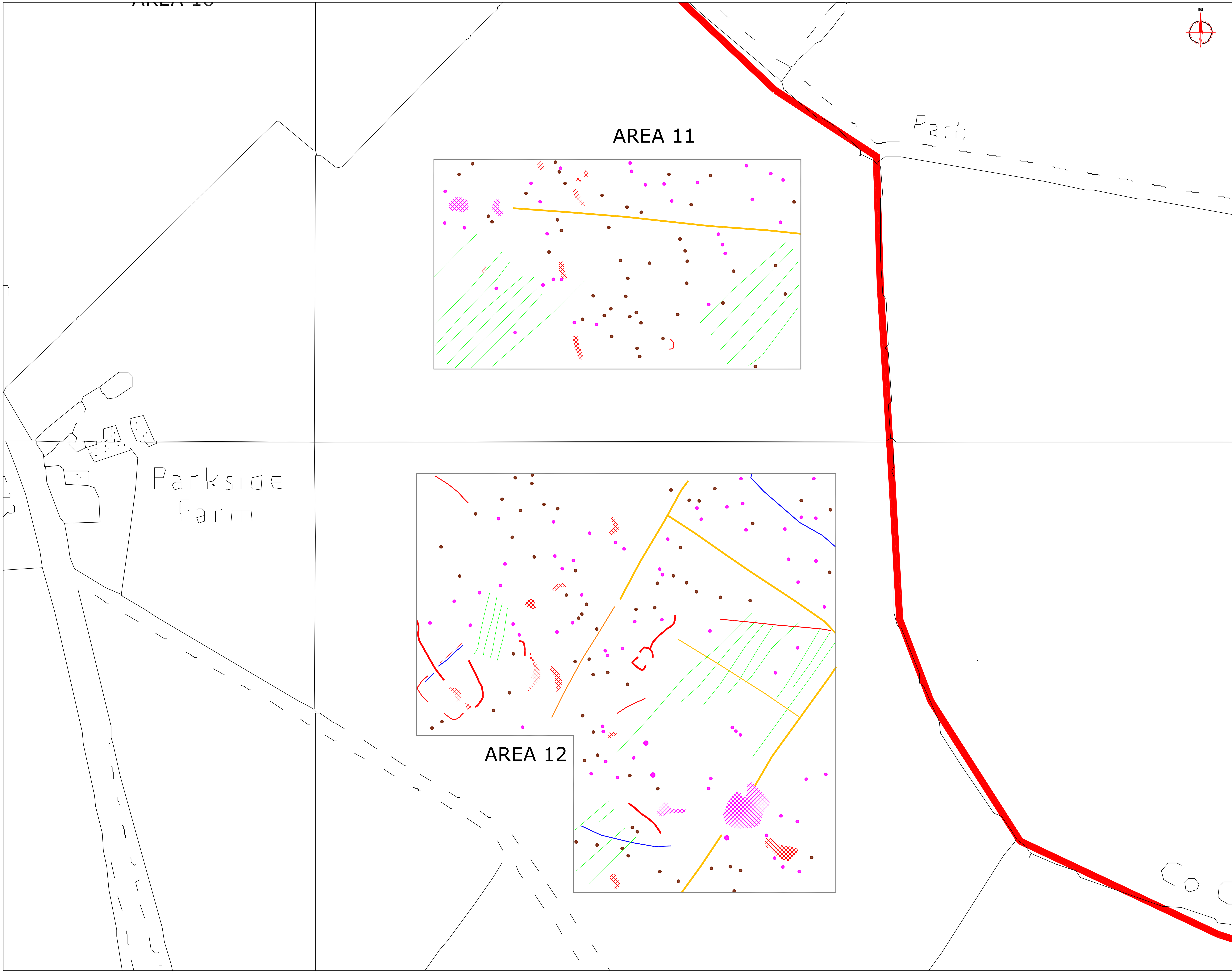
Scale 1:1000 0m 10 20 30 40 50 60m

Plot	Checked by	Issue No.
A1	PPB	01

Date	Drawn by	Figure No.
JUNE 07	RAJS	26



Amendments

Issue No.	Date	Description
-	-	-
		-

KEY

- Positive area anomaly- cut feature of possible archaeological origin
- Magnetic disturbance
- Positive linear anomaly- possible archaeological origin
- Negative linear anomaly- possible former earthwork/bank
- Agricultural mark
- Possible former field boundary
- Discrete positive anomaly- possible pit
- Discrete positive anomaly with negative response - ferrous object

Job No.	Survey Date
2324	MAY 07

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY- NEWTON-LE-WILLOWS, MERSEYSIDE

Subject

INTERPRETATION- AREAS 11 AND 12

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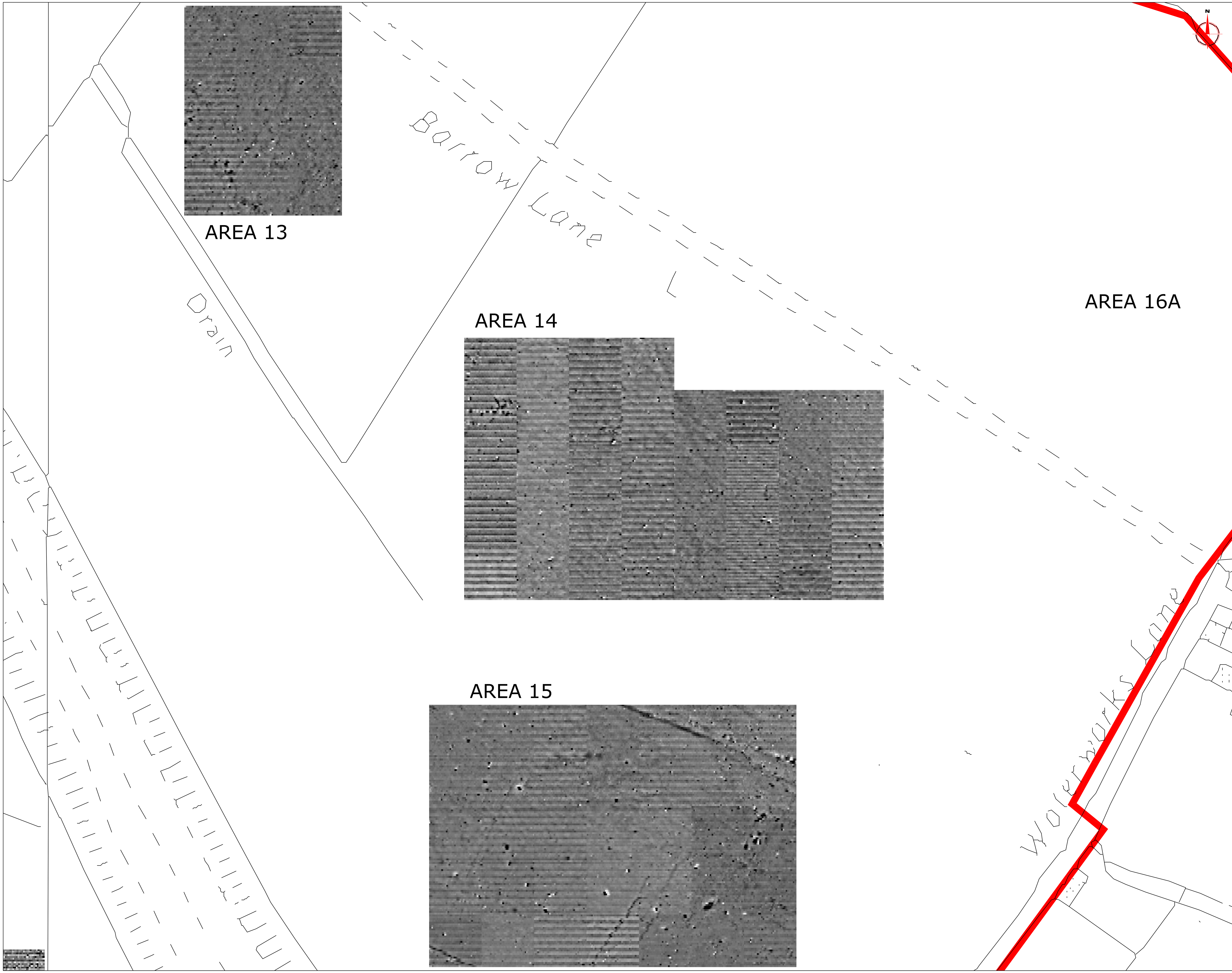
REGISTERED ORGANISATION IFA

Scale 1:1000 (0m 10 20 30 40 50 60m)

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	27



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

Plotting parameters
Area 13
Maximum +5nT (black)
Minimum -5nT (white)
-3SD +3SD
+5nT
-5nT

Plotting parameters
Area 14
Maximum +5nT (black)
Minimum -5nT (white)
-3SD +3SD
+5nT
-5nT

Plotting parameters
Area 15
Maximum +5nT (black)
Minimum -5nT (white)
-3SD +3SD
+5nT
-5nT

Job No. 2324
Survey Date MAY 2007

Client
OXFORD ARCHAEOLOGY NORTH

Project Title
GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject
PLOT OF RAW GRADIOMETER
DATA- AREAS 13 TO 15

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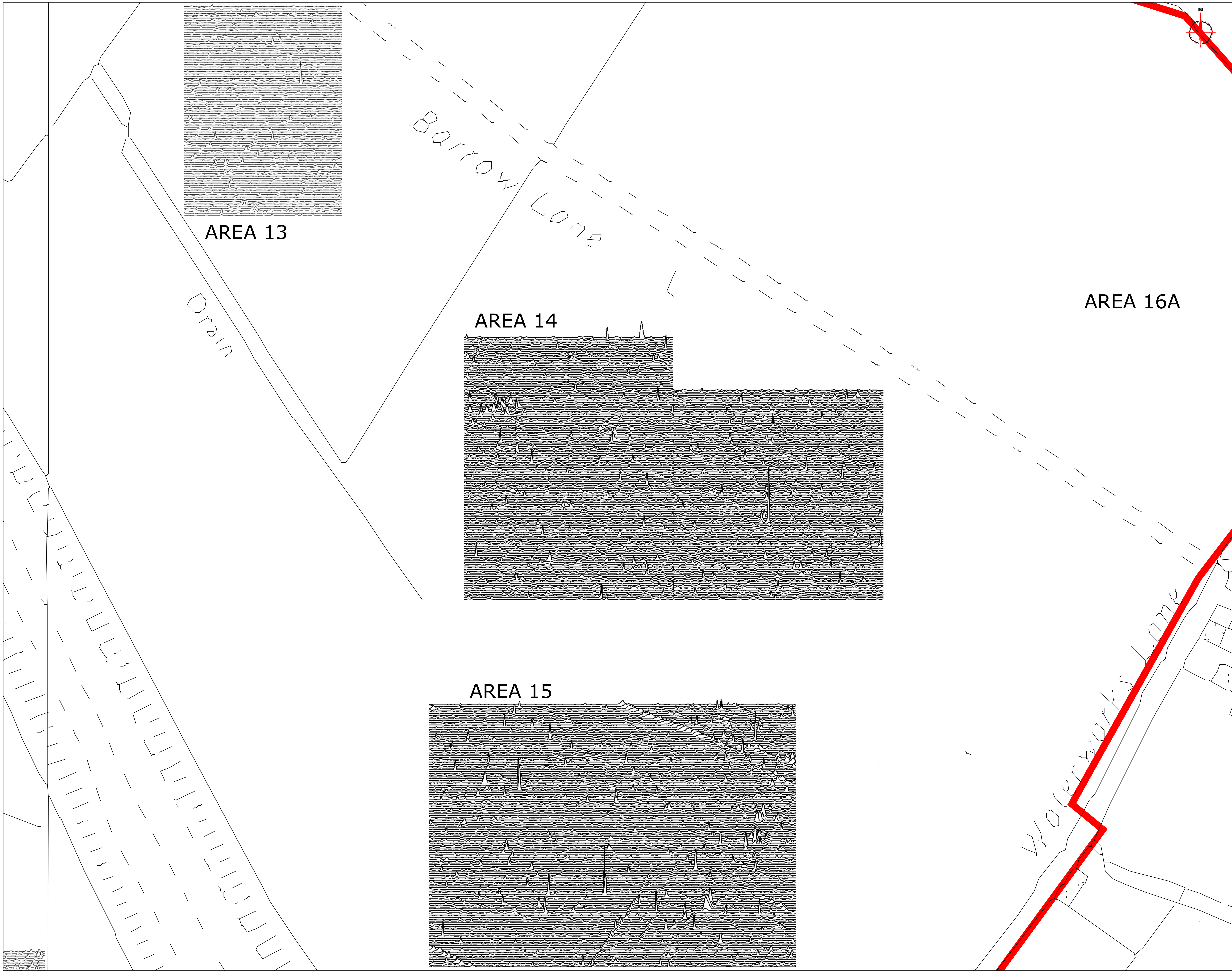
Scale 1:1000
0m 10 20 30 40 50 60m

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	28



Amendments

Issue No.	Date	Description
-	-	-
		-

Plotting parameters

+40nT

(Positive values displace above the trace line. Hidden values have not been plotted)

200nT
160nT
120nT
80nT
40nT
0nT

Job No. 2324

Survey Date MAY 07

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY- NEWTON-LE-WILLOWS, MERSEYSIDE

Subject

TRACE PLOT SHOWING POSITIVE VALUES- AREAS 13-15

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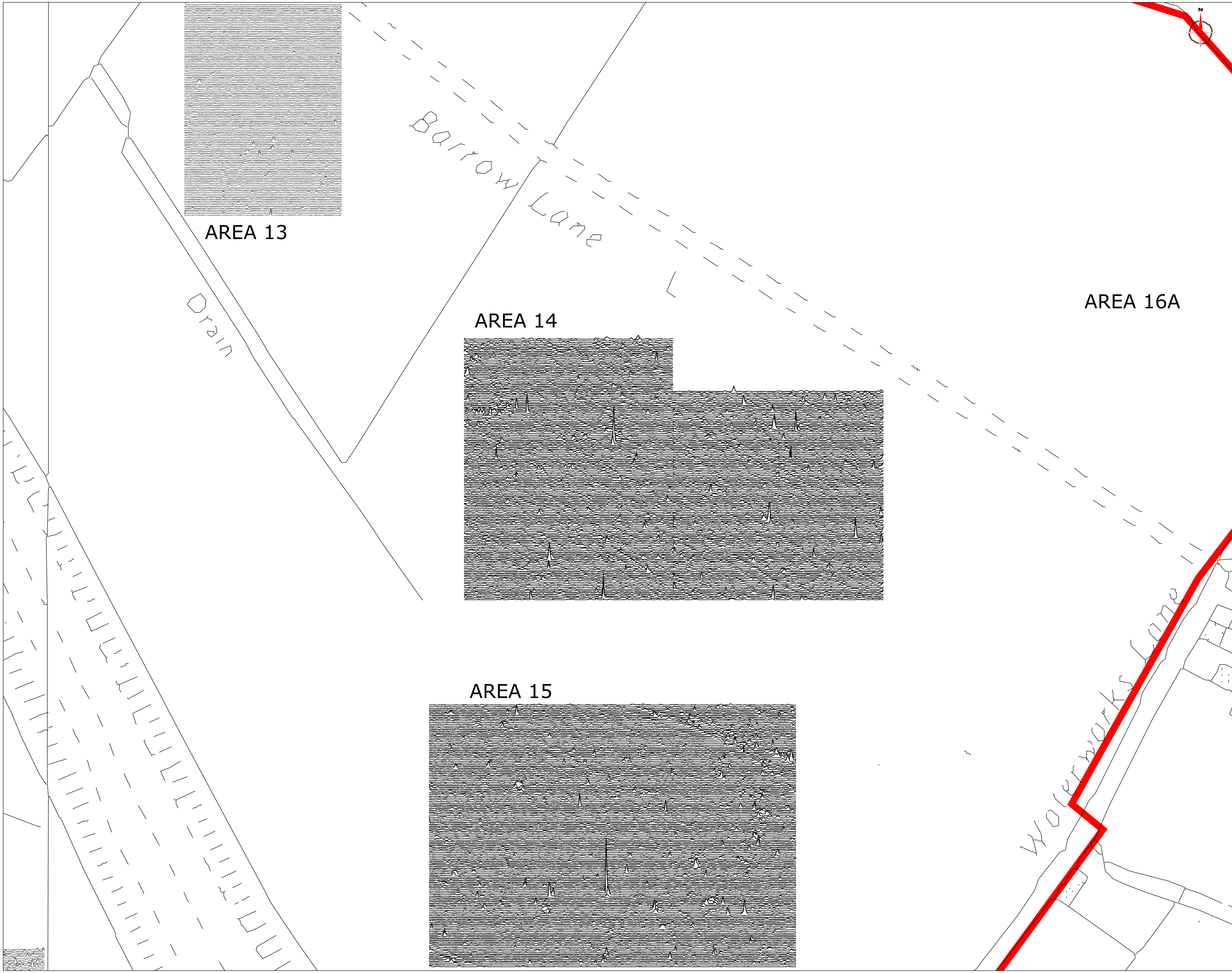
Scale 1:1000

0m 10 20 30 40 50 60m

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	29



Amendments		
Issue No.	Date	Description
-	-	-
		-

Plotting parameters

-40nT

(Negative values displace above the trace line. Hidden values have not been plotted)

-200nT
-160nT
-120nT
-80nT
-40nT
0nT

Job No. 2324	Survey Date MAY 07

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject

TRACE PLOT SHOWING NEGATIVE VALUES- AREAS 13-15

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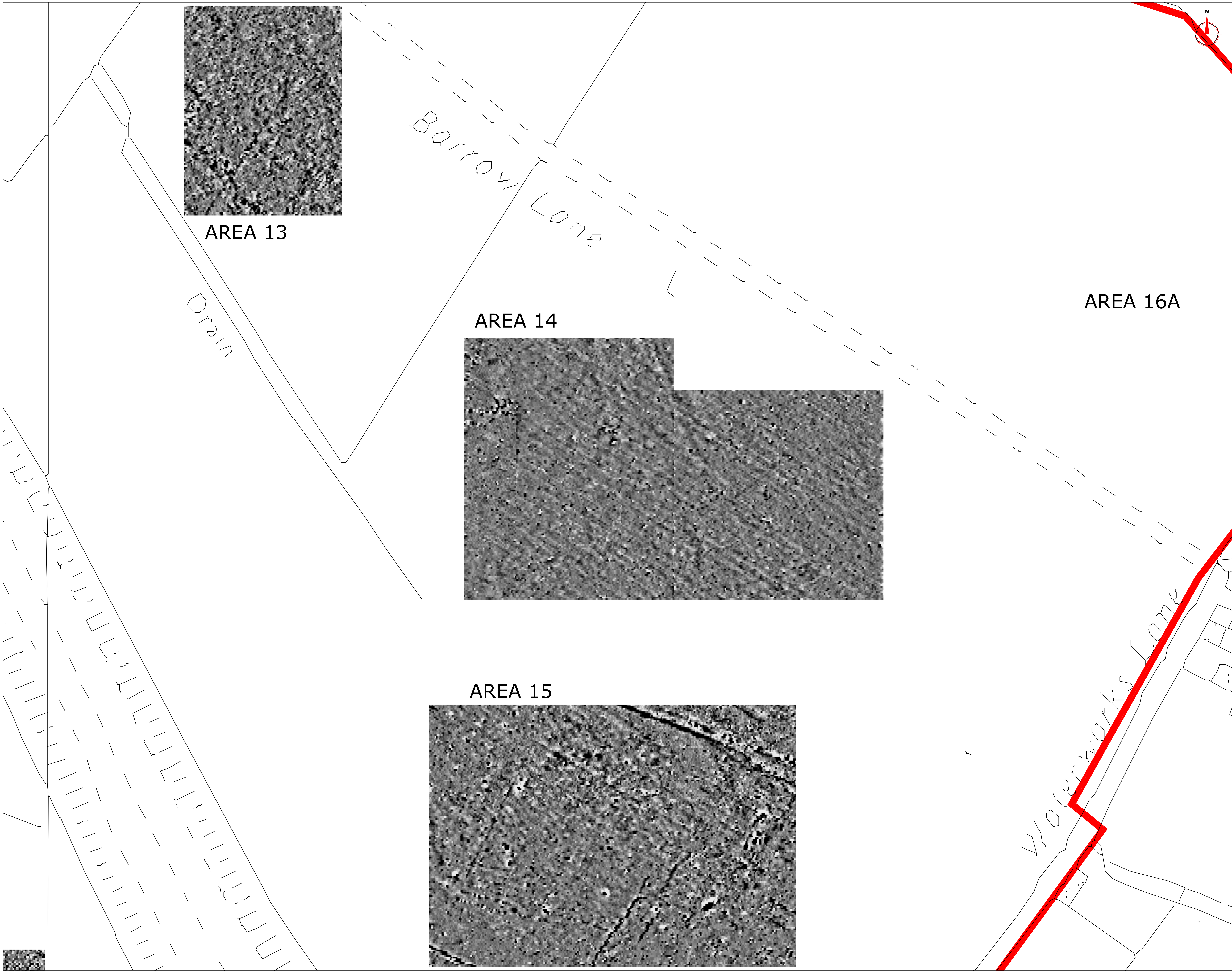
Scale 1:1000 — 0m 10 20 30 40 50 60m

Plot A1	Checked by PPB	Issue No. 01
Date JUNE 07	Drawn by RAJS	Figure No. 30



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

Plotting parameters
Area 13
Maximum +1nT (black)
Minimum -1nT (white)
-3SD +3SD
+1nT -1nT

Plotting parameters
Area 14
Maximum +2nT (black)
Minimum -2nT (white)
-3SD +3SD
+2nT -2nT

Plotting parameters
Area 15
Maximum +2nT (black)
Minimum -2nT (white)
-3SD +3SD
+2nT -2nT

Job No. 2324
Survey Date MAY 2007

Client
OXFORD ARCHAEOLOGY NORTH

Project Title
GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject
PLOT OF PROCESSED
GRADIOMETER DATA-
AREAS 13 TO 15

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Scale 1:1000 0m 10 20 30 40 50 60m

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	31

Amendments

Issue No.	Date	Description
-	-	-
		-

KEY

	Positive area anomaly- cut feature of possible archaeological origin
	Magnetic disturbance
	Positive linear anomaly- possible archaeological origin
	Negative linear anomaly- possible former earthwork/bank
	Agricultural mark
	Possible former field boundary
	Linear anomaly- possible land drain
	Discrete positive anomaly- possible pit
	Discrete positive anomaly with negative response - ferrous object

Job No.	Survey Date
2324	MAY 07

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject

INTERPRETATION-
AREAS 13 TO 15

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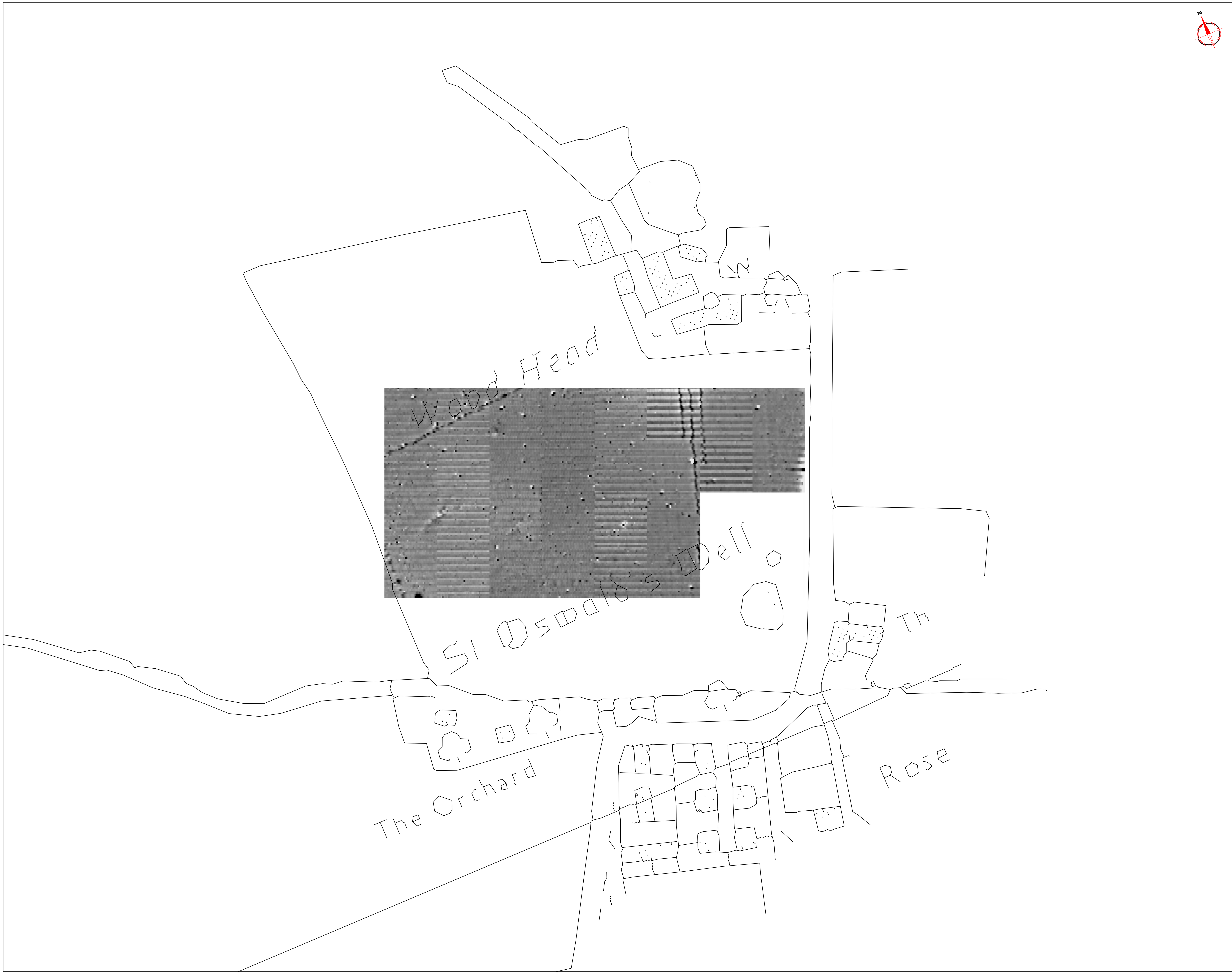
Scale 1:1000 (0m 10 20 30 40 50 60m)

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	32



Amendments		
Issue No.	Date	Description
-	-	-
-	-	-

Plotting parameters

Maximum +5nT (black)
Minimum -5nT (white)

-3SD +3SD

+5nT
-5nT

Job No. 2324	Survey Date MAY 2007

Client
OXFORD ARCHAEOLOGY NORTH

Project Title
GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject
PLOT OF RAW GRADIOMETER
DATA- AREA 16

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Scale 1:1000
0m 10 20 30 40 50 60m

Plot A1	Checked by PPB	Issue No. 01
Date JUNE 07	Drawn by RAJS	Figure No. 33

Amendments

Issue No.	Date	Description
-	-	-
		-

Plotting parameters

+40nT

(Positive values displace above the trace line. Hidden values have not been plotted)

200nT
160nT
120nT
80nT
40nT
0nT

Job No.	Survey Date
2324	MAY 07

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY- NEWTON-LE-WILLOWS, MERSEYSIDE

Subject

TRACE PLOT SHOWING POSITIVE VALUES- AREA 16

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Scale
1:1000
0m 10 20 30 40 50 60m

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	34

Amendments

Issue No.	Date	Description
-	-	-
		-

Plotting parameters

-40nT

(*Negative values displace above the trace line. Hidden values have not been plotted*)

-200nT
-160nT
-120nT
-80nT
-40nT
0nT

Job No.	Survey Date
2324	MAY 07

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY- NEWTON-LE-WILLOWS, MERSEYSIDE

Subject

TRACE PLOT SHOWING NEGATIVE VALUES- AREA 16

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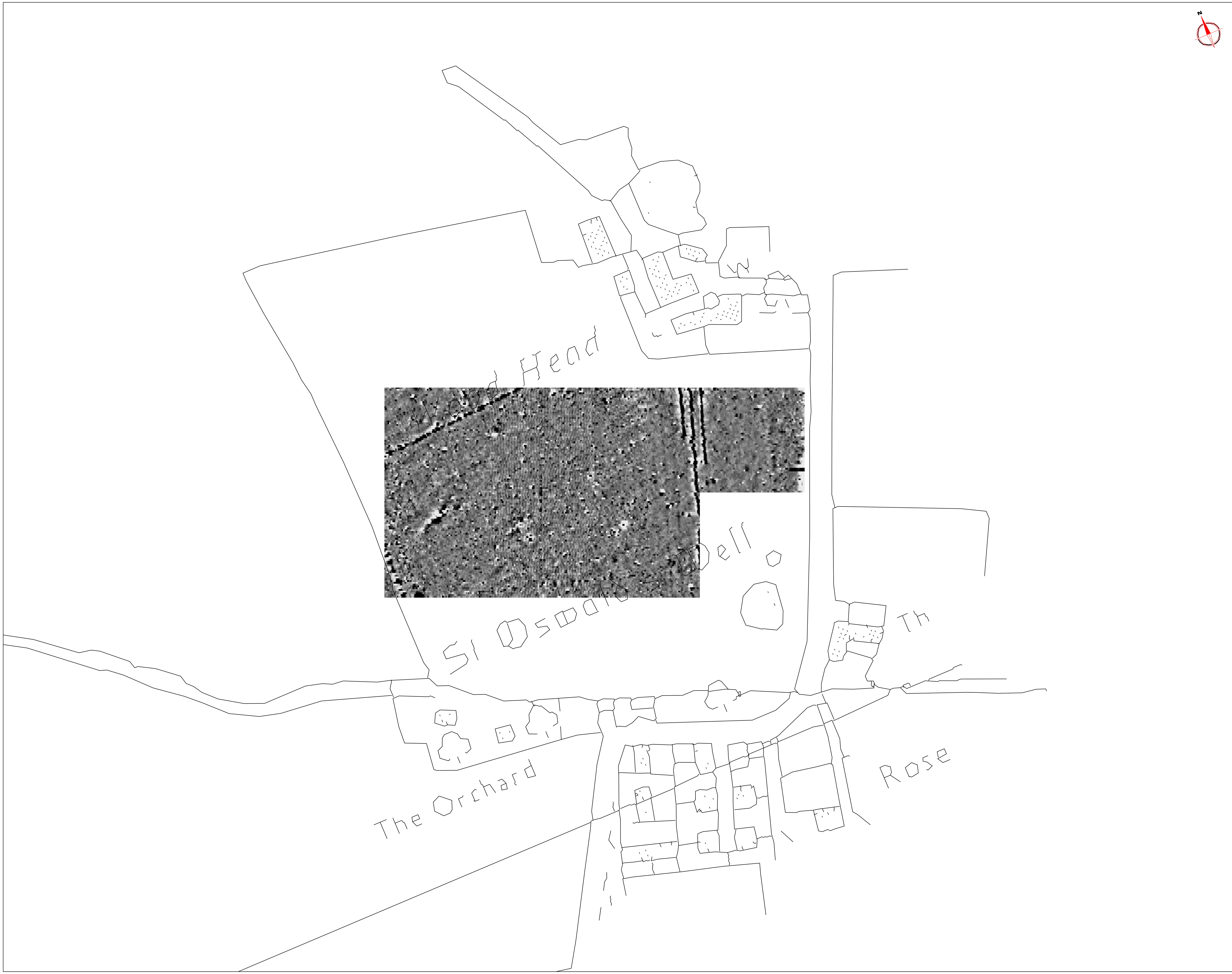
Scale 1:1000 — 0m 10 20 30 40 50 60m

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	35



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

Plotting parameters

Maximum +1nT (black)
Minimum -1nT (white)

-3SD +3SD

+1nT
-1nT

Job No.	Survey Date
2324	MAY 2007

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject

PLOT OF PROCESSED
GRADIOMETER DATA- AREA 16

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Scale
1:1000
0m 10 20 30 40 50 60m

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	36

Amendments

Issue No.	Date	Description
-	-	-
		-

KEY

- Positive area anomaly- cut feature of possible archaeological origin
- Magnetic disturbance
- Magnetic disturbance- related to metallic fences
- Positive linear anomaly- possible archaeological origin
- Negative linear anomaly- possible former earthwork/bank
- Agricultural mark
- Possible former field boundary
- Linear anomaly- possible land drain
- Discrete positive anomaly- possible pit
- Discrete positive anomaly with negative response - ferrous object

Job No.	Survey Date
2324	MAY 07

Client
OXFORD ARCHAEOLOGY NORTH

Project Title
GEOPHYSICAL SURVEY- NEWTON-LE-WILLOWS, MERSEYSIDE

Subject
INTERPRETATION- AREA 16

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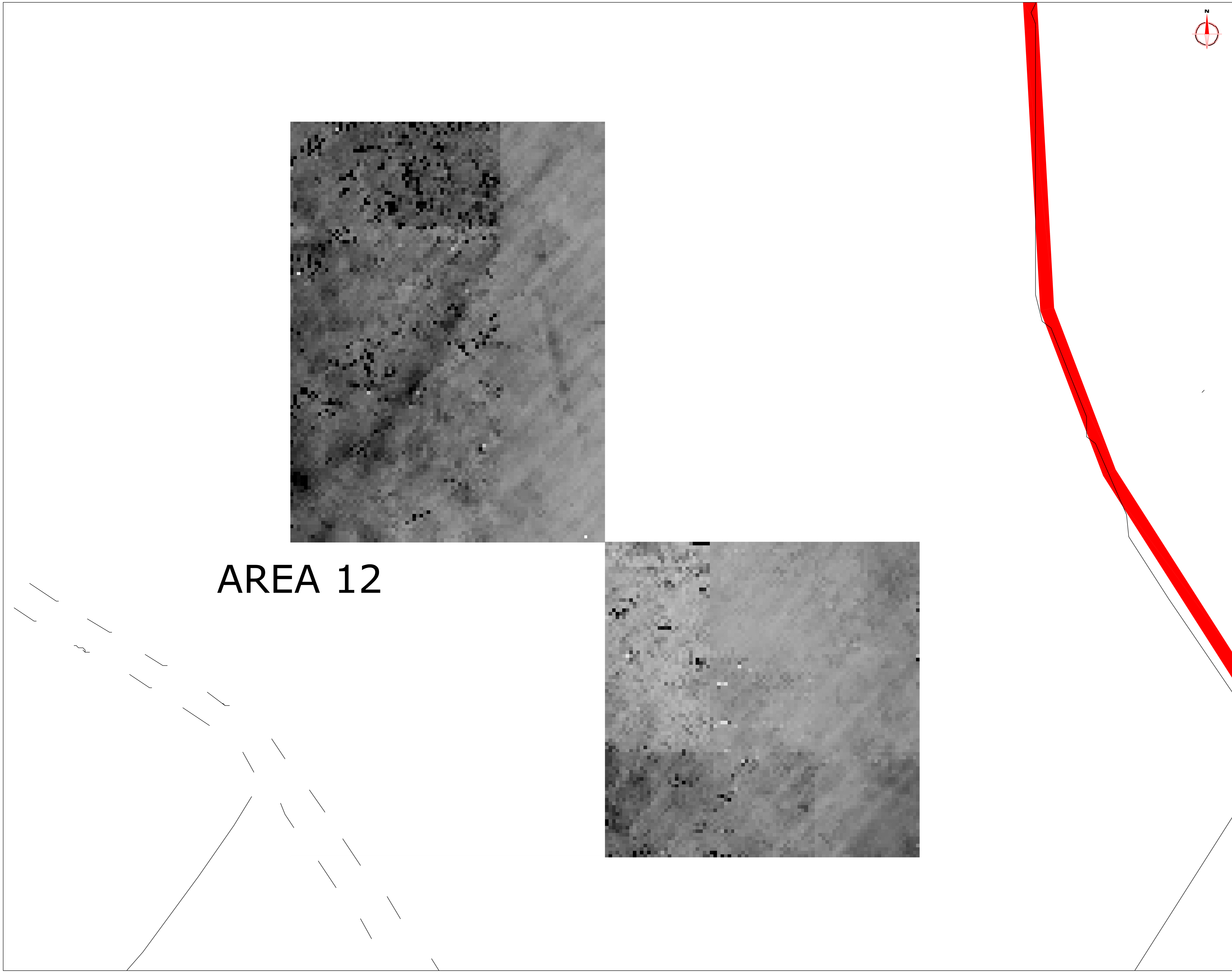
Scale 1:1000 (0m 10 20 30 40 50 60m)

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	37



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

Plotting parameters

Maximum +200Ω (black)
Minimum +28Ω (white)

-3SD +3SD

+200Ω
+28Ω

Job No.	Survey Date
2324	MAY 2007

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS

Subject

PLOT OF RAW RESISTANCE DATA

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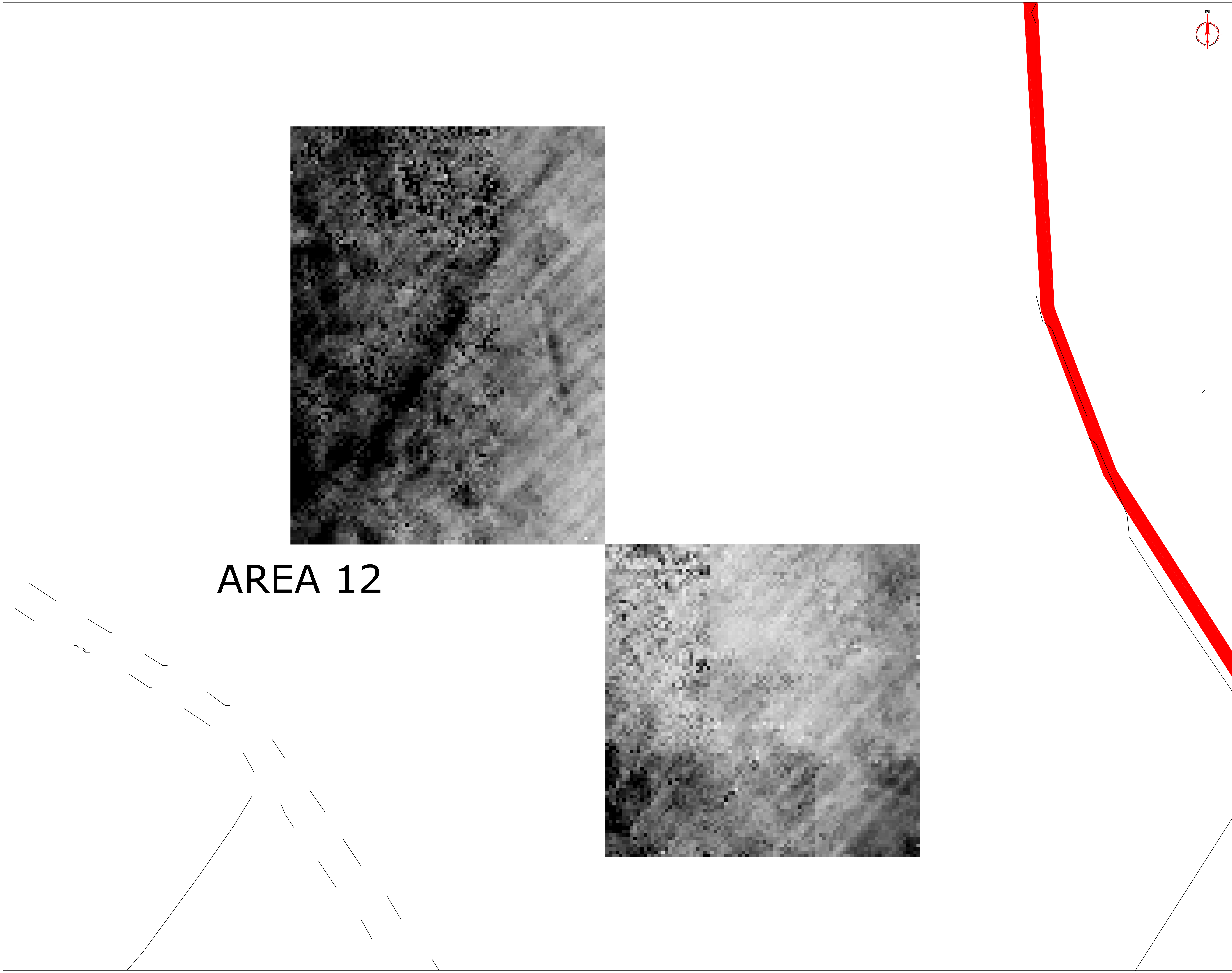
Scale 1:500 — 0m 5 10 15 20 25 30m

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	38



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

Plotting parameters

Maximum +150Ω (black)
Minimum +70Ω (white)

-3SD +3SD

+150Ω
+70Ω

Job No. 2324	Survey Date MAY 2007

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject

PLOT OF PROCESSED
RESISTANCE DATA

STRATASCAN™
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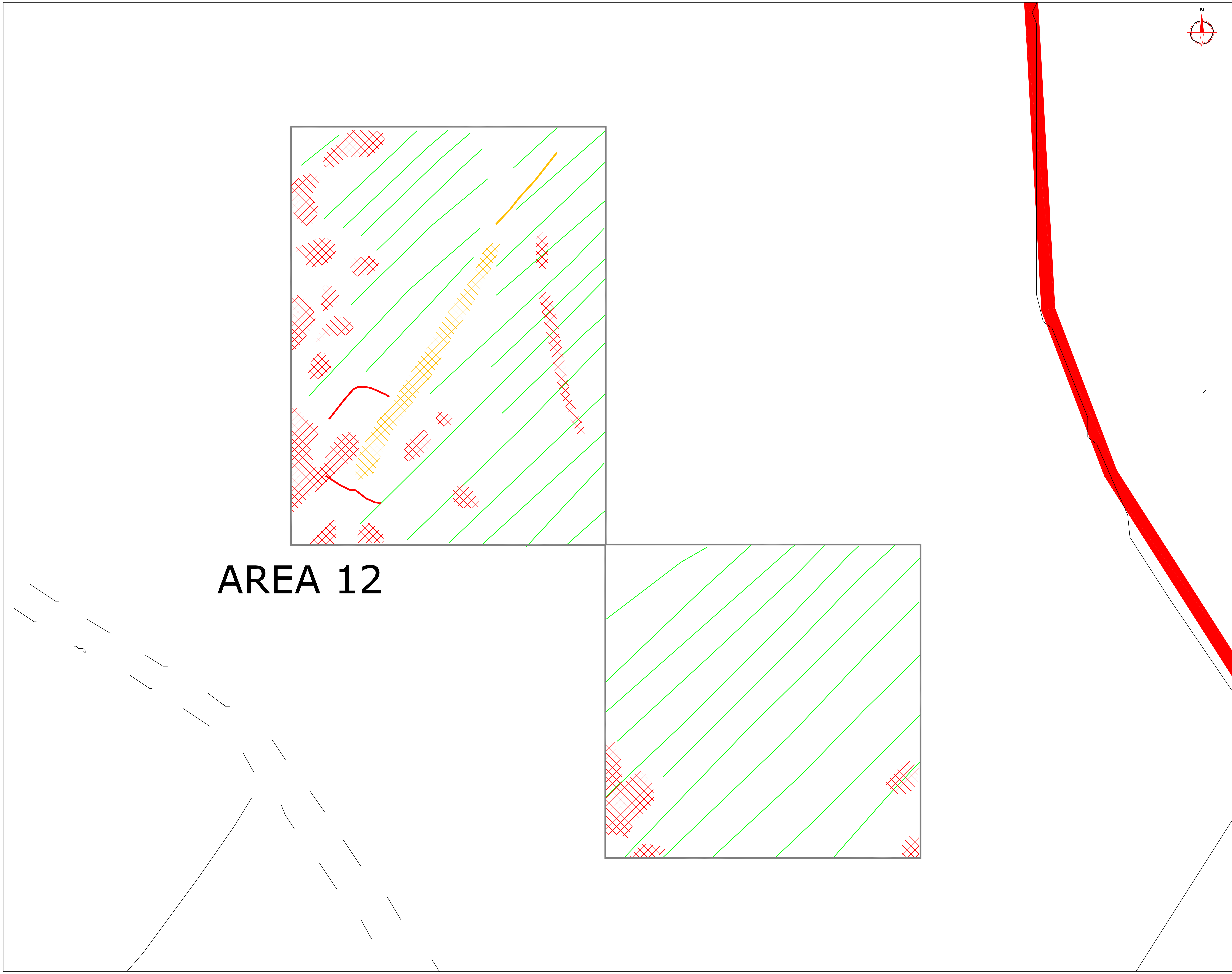
Scale 1:500 — 0m 5 10 15 20 25 30m

Plot A1	Checked by PPB	Issue No. 01
Date JUNE 07	Drawn by RAJS	Figure No. 39



Amendments

Issue No.	Date	Description
-	-	-
		-

KEY

(red line)	High resistance linear anomaly - possible structural remains or compacted ground
(green line)	Agricultural mark
(orange line)	High resistance linear anomaly- possibly related to former field boundary
(red hatch)	High resistance area anomaly - possible structural remains or compacted ground
(yellow hatch)	High resistance area anomaly - possibly related to former field boundary

Job No.	Survey Date
2324	MAY 07

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY-
NEWTON'LE'WILLOWS,
MERSEYSIDE

Subject

INTERPRETATION OF
RESISTIVITY ANOMALIES

STRATASCAN™
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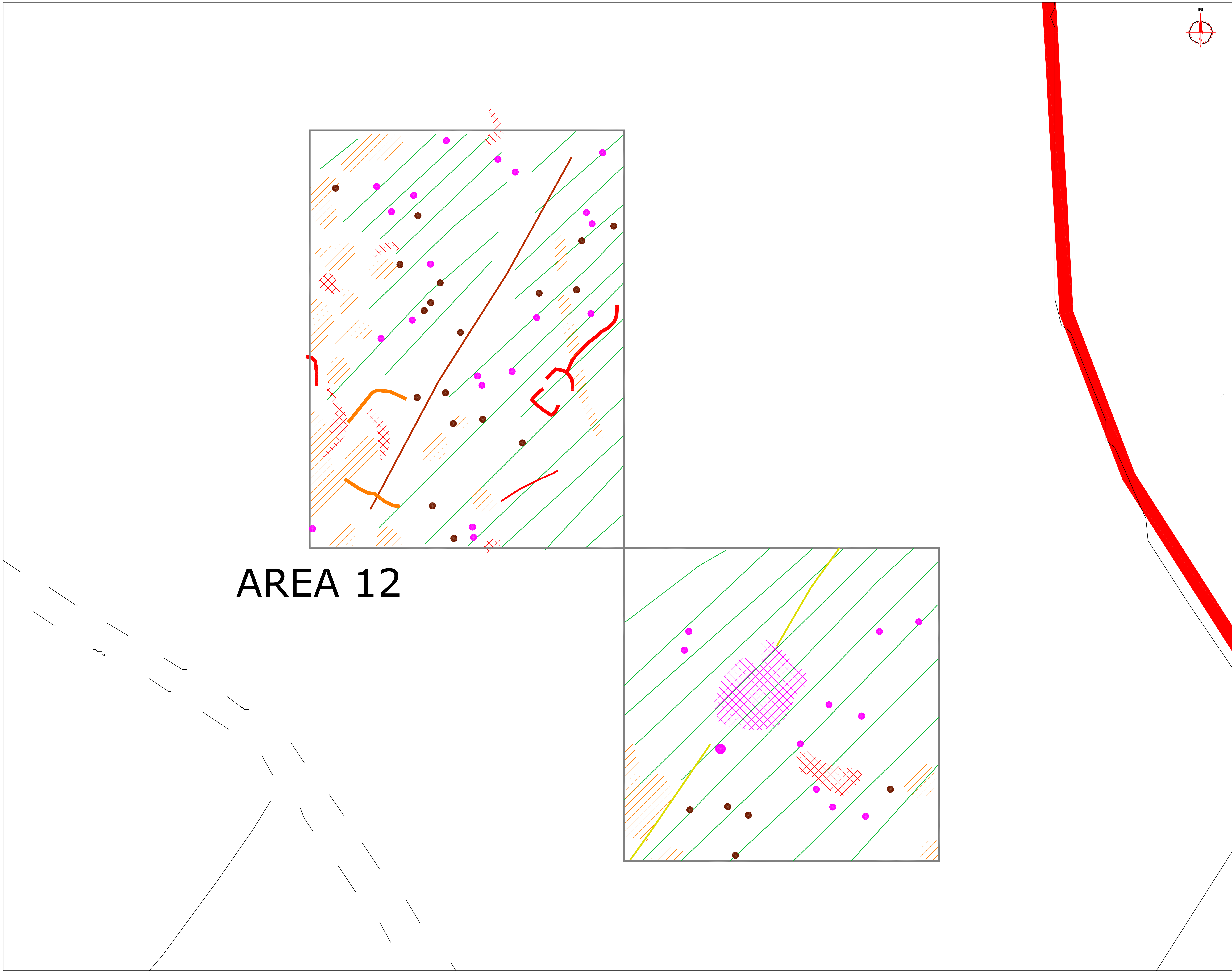
Scale 1:500 — 0m 5 10 15 20 25 30m

Plot	Checked by	Issue No.
A1	PPB	01

Date	Drawn by	Figure No.
JUNE 07	RAJS	40



Amendments

Issue No.	Date	Description
-	-	-
		-

KEY

- Agricultural mark- evident in both magnetometry and resistivity data sets
- Former field boundary- evident in both magnetometry and resistivity data sets

MAGNETOMETRY

- Positive linear anomaly- cut feature of possible archaeological origin
- Positive linear anomaly- possible former field boundary
- Positive area anomaly- cut feature of possible archaeological origin
- Magnetic disturbance
- Discrete positive anomaly- possible pit
- Bipolar anomaly- ferrous object

RESISTANCE

- High resistance linear anomaly - possible structural remains or compacted ground
- High resistance area anomaly - possible structural remains or compacted ground

Job No. 2324

Survey Date MAY 2007

Client
OXFORD ARCHAEOLOGY NORTH

Project Title
GEOPHYSICAL SURVEY-
NEWTON-LE-WILLOWS,
MERSEYSIDE

Subject
COMBINED MAGNETOMETRY AND
RESISTANCE INTERPRETATION

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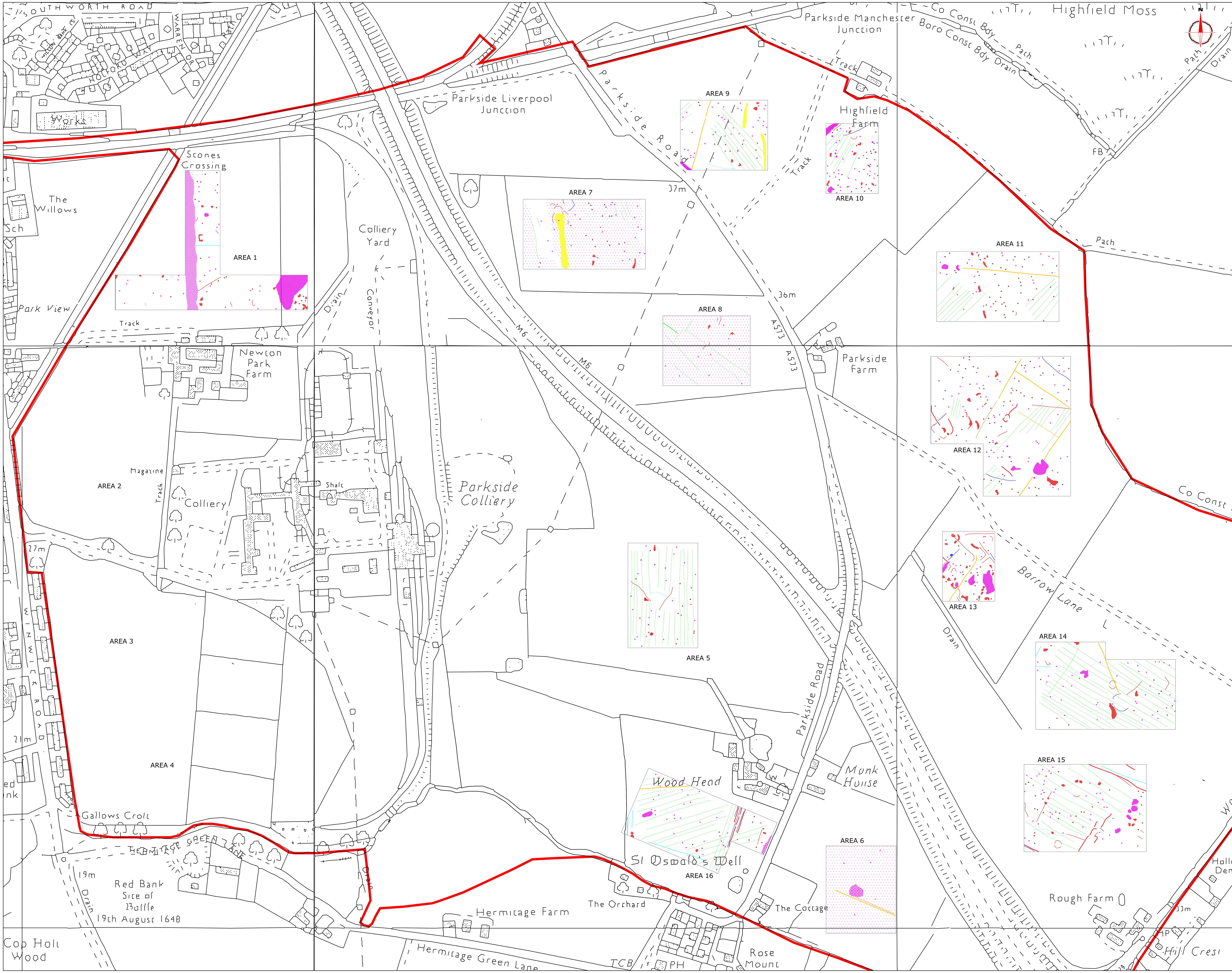
Scale 1:500 — 0m 5 10 15 20 25 30m

Plot	Checked by	Issue No.
A1	PPB	01
Date	**Drawn by**	**Figure No.**
JUNE 07	RAJS	41



Issue No.	Date	Description
-	-	-

Amendments

KEY

- Positive area anomaly- cut feature of possible archaeological origin
- Magnetic disturbance
- Magnetic disturbance- related to pipe/cable
- Magnetic disturbance- uncertain origin
- Magnetic disturbance- related to metallic fences
- Possible thermoremnant feature
- Possible geological/pedological response
- Positive linear anomaly- possible archaeological origin
- Negative linear anomaly- possible former earthwork/bank
- Agricultural mark
- Positive linear anomaly- former field boundary
- Negative linear anomaly- former field boundary
- Linear anomaly- possible land drain
- Discrete positive anomaly- possible pit
- Discrete positive anomaly with negative response - ferrous object

Job No.	Survey Date
2324	MAY 2007

Client

OXFORD ARCHAEOLOGY NORTH

Project Title

GEOPHYSICAL SURVEY- NEWTON-LE-WILLOWS, MERSEYSIDE

Subject

INTERPRETATION OF MAGNETOMETER ANOMALIES

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Scale 1:3000 — 0m 30 60 90 120 150 180

Plot	Checked by	Issue No.
A1	PPB	01

Date	Drawn by	Figure No.
JUNE 07	RAJS	42