
**LAND AT
TURNCOLE WINDFARM,
SOUTH MINSTER,
ESSEX**

GEOPHYSICAL SURVEY

**Work undertaken for
RES**

August 2014

**Report produced by
Jonathon Smith BA (Hons), MA**

**OASIS Ref: archaeo11-189687
National Grid Reference: TQ 98556 97956
Planning No: FUL/MAL/10/01070
Accession No: COLEM:2014.74**

APS Report No: **85/14**

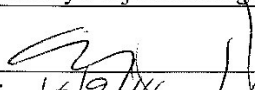
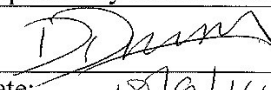
**ARCHAEOLOGICAL
PROJECT
SERVICES**



Quality Control
Turncole Wind Farm,
Southminster,
Essex,

SMTW14

Project Coordinator	Dale Trimble and Neil Jefferson
Site Staff	Jonathon Smith, Ryan Godbold and Mary Nugent
Survey processing and report	Jonathon Smith

Checked by Project Manager	Approved by Team Leader
 Gary Taylor	 Denise Drury
Date: 16/9/14	Date: 18/9/14

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1. SUMMARY

Detailed magnetic gradiometer survey was undertaken for RES in connection with proposed development on land at Turncole Wind Farm, Southminster, Essex. The survey totalled c. 12.5ha.

Aerial photography has suggested that the site was marshland crossed with creeks and previous archaeological trial trenching indicates Roman salt making may have been conducted on the site. The geophysical survey revealed three possible salterns and a broad network of thirty-seven undated drainage ditches. In addition one positive linear feature on a separate alignment to the drainage ditches was identified and may have archaeological significance.

2. INTRODUCTION

2.1 Definition of an Evaluation

Geophysical survey is a non-intrusive method of archaeological evaluation. Evaluation is defined as ‘*a limited programme of non-intrusive and/or intrusive fieldwork which determines the presence or absence of archaeological features, structures, deposits, artefacts or ecofacts within a specified area or site. If such archaeological remains are present Field Evaluation defines their character and extent, quality and preservation, and it enables an assessment of their worth in a local, regional, national or international context as appropriate*’ (IfA 2008).

2.2 Background

Archaeological Project Services was commissioned by RES to undertake a detailed magnetometer survey totalling some 12.5ha on land at Turncole Wind Farm, Southminster, Essex. This was in

advance of proposed development of the area.

Aerial photography has suggested that the site was marshland crossed with creeks and previous archaeological trial trenching indicates Roman salt making may have been conducted on the site (Garland 2010). The survey was carried out over six days between 6th August and 4th September 2014 in accordance with the written scheme of investigation.

2.3 Topography and Geology

The site (centred approximately on NGR TQ 98556 97956) is located at Turncole Farm, to the south-east of Southminster and north-east of Burnham-on-Crouch in the Maldon District of Essex (Figs 1 and 2). The site lies at about 10m O.D.

The British Geological Survey (BGS) sheet (259) shows that the site lies on London Clay overlain by alluvium.

3. GEOPHYSICAL SURVEY

3.1 Methods

Location and layout of the survey area is shown in Figure 3. The survey has been split into two areas for the ease of presenting results (A and B). The survey area follows the proposed layout of infrastructure, with survey grids centred on the road.

The site was flat and covered with recently harvested crops, which made it ideal for surveying. However, parts of Area A were covered in windrows which meant a few insignificant gaps in the survey had to be left. Weather was generally warm and bright.

Survey was undertaken in accordance with

English Heritage (2008) and IfA (2011) guidelines and codes of conduct.

The magnetic survey was carried out using a dual sensor Grad601-2 Magnetic Gradiometer manufactured by Barrington Instruments Ltd. This records subtle changes in the magnetic field resulting from differing features in the soil. Changes as small as 0.2 nanoTesla (nT) in an overall field strength of c. 49,000nT can be accurately detected using this instrumentation, although in practice instrument interference and soil noise can limit sensitivity.

The mapping of anomalies in a systematic manner allows interpretation of the type of material present beneath the surface. Strong magnetic anomalies are generated by buried iron-based objects or by kilns or hearths, usually resulting in a bipolar (positive/negative) response. More subtle positive anomalies representing pits and ditches can be seen where these contain more topsoil which is normally richer in magnetic iron oxides and provides a contrast with the natural subsoil (but this can vary depending on the nature of the underlying deposits). A negative anomaly may result from upcast bank material. Wall foundations can also show as negative anomalies where the stone is less magnetic than the surrounding soil, or as stronger positive and negative anomalies if of brick, but are not always responsive to the technique. It should be noted that not all features will be responsive and absence of anomalies does not necessarily indicate absence of archaeological features.

Magnetometers measure changes in the Earth's magnetic field. With two sensors configured as a gradiometer the recorded values indicate the difference between two magnetic measurements separated by a fixed distance. The Grad601-2 consists of two high stability fluxgate gradiometers

suspended on a single frame with a 1m separation between the sensing elements giving a strong response to deep anomalies.

Sampling interval and data capture

Readings were taken at 0.25m intervals along traverses 1m apart. This equates to 3600 sampling points in a full 30m x 30m grid. The Grad 601 has a typical depth of penetration of 0.5m to 1.0m although a greater range is possible where strongly magnetic objects have been buried in the site.

Readings are logged consecutively into the data logger which is downloaded daily either into a portable computer whilst on site or directly to the office computer. At the end of each job, data is transferred to the office for processing and presentation.

Processing and presentation of results

Processing is performed using specialist TerraSurveyor software. 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 (Destripe or zero median traverse). Despiking is also performed to reduce the effect of the anomalies resulting from small iron objects often found on agricultural land. Further processing can then be carried out which may include low pass filtering to reduce 'noise' in the data and hence emphasise the archaeological or man-made anomalies.

The following are the processing techniques carried out on the processed gradiometer data used in this report:

1. DeStripe (sets the background median of each traverse within a grid to zero and is useful for removing striping effects)

2. Despiking (useful for display and allows further processing functions to be carried out more effectively by removing extreme data values)

Parameters: X radius = 2; Y radius = 2; Threshold = 3SD; Spike replacement = mean

3. Clip (excludes extreme values allowing better representation of detail in the mid range): -5 to 5nT.

3.2 Results

The presentation of the data for the site involves a print-out of the raw or minimally processed data as greyscale plots (Figs 4 and 7; clipped for display but otherwise unprocessed), together with greyscale plots of the processed data (Figs 5 and 8). Magnetic anomalies have been identified and plotted onto interpretative drawings (Figs 6 and 9) and overlain onto the proposed infrastructure scheme (Fig 10).

Positive linear anomalies

There are thirty-nine positive linear anomalies identified in the survey. Thirty-seven of these are arranged in networks of parallel linears, mostly spaced at 30m apart (these are shown in blue). These are very likely to be drainage ditches, possibly related to land reclamation from the marshes. These ditches do not appear on the earliest 1873 Ordnance Survey map of the area and probably predate it. One linear runs at an angle to the others and may represent an earlier archaeological feature (shown in red). Additionally, one linear in Area A matches a ditch shown on 20th century maps and represents a recent change in the field system (shown in green).

Discrete positive anomalies

No discrete positive anomalies can be distinguished with certainty from the background geology.

Discrete bipolar anomalies

Many small bipolar anomalies are visible on the survey. These are likely to be fragments of iron in the topsoil. These have not been highlighted.

There are three large bi-polar anomalies in Area A (shown in red circles). These have field strengths of over 100nT and dispersed cores. This suggests they may be caused by spreads of highly fired clay from buried salterns rather than single lumps of iron.

Modern/magnetic disturbance

Three patches of modern magnetic disturbance were observed in the survey (highlighted with green circles). These were due to recent ground works and piles of metal objects, clearly visible on the surface in the course of conducting the survey.

Geological Features

There are large areas of low-level geological disturbance which might mask weaker features. These patches of disturbance may be a result of moving waterways, given that aerial images suggest the neighbouring fields were criss-crossed by many small meandering creeks before the marsh was drained.

Physical Barriers

The south of Area A has several white stripes running north-south along its length. These are windrows left after harvesting and proved impossible to walk over, leaving blanks in the survey data. This was not thought to have a significant effect on the data obtained.

4. DISCUSSION

The survey has revealed a network of drainage ditches across the site. Although no solid dating can be put forwards for these (except to say they predate the 1873 ordnance survey map), their extent and regularity suggest a post-medieval or early modern origin and they probably relate to attempts to drain the marsh. One linear clearly is not orientated on the same alignment as the drainage ditches or the current field, which may indicate an earlier ditch or possible archaeological feature.

Three possible salterns were identified in the southern half of Area A, based on their setting, size, form and the strength of magnetic signal.

An archaeological trial trench in 2010 identified a 'red mound' associated with roman salt making in Area A. No trace of this can be seen in the geophysical survey (although its location has been marked in Fig 10). This is probably due to a high level of interference from the background geology in this area.

5. ACKNOWLEDGEMENTS

Archaeological Project Services wishes to acknowledge RES who commissioned the project; Gary Taylor and Denise Drury (APS) edited the report.

6. PERSONNEL

Project coordinator: Dale Trimble and Neil Jefferson
 Geophysical Survey: Jonathon Smith, Ryan Godbold and Mary Nugent
 Survey processing and reporting: Jonathon Smith.

7. BIBLIOGRAPHY

BGS, 1989 *Southend and Foulness; solid and drift edition*, 1:50 000 map sheet **259**

English Heritage, 2008 *Geophysical Survey in Archaeological Field Evaluation*.

Garland, N. 2010. *An Archaeological Evaluation at Turncole Farm, Southminster, Essex*. Archaeology South-East: Portslade.

IfA, 2008 *Standard and Guidance for Field Evaluation*.

IfA, 2011 *Standard and Guidance for Geophysical Survey*.

8. ABBREVIATIONS

BGS British Geological Survey
 IfA Institute for Archaeologists

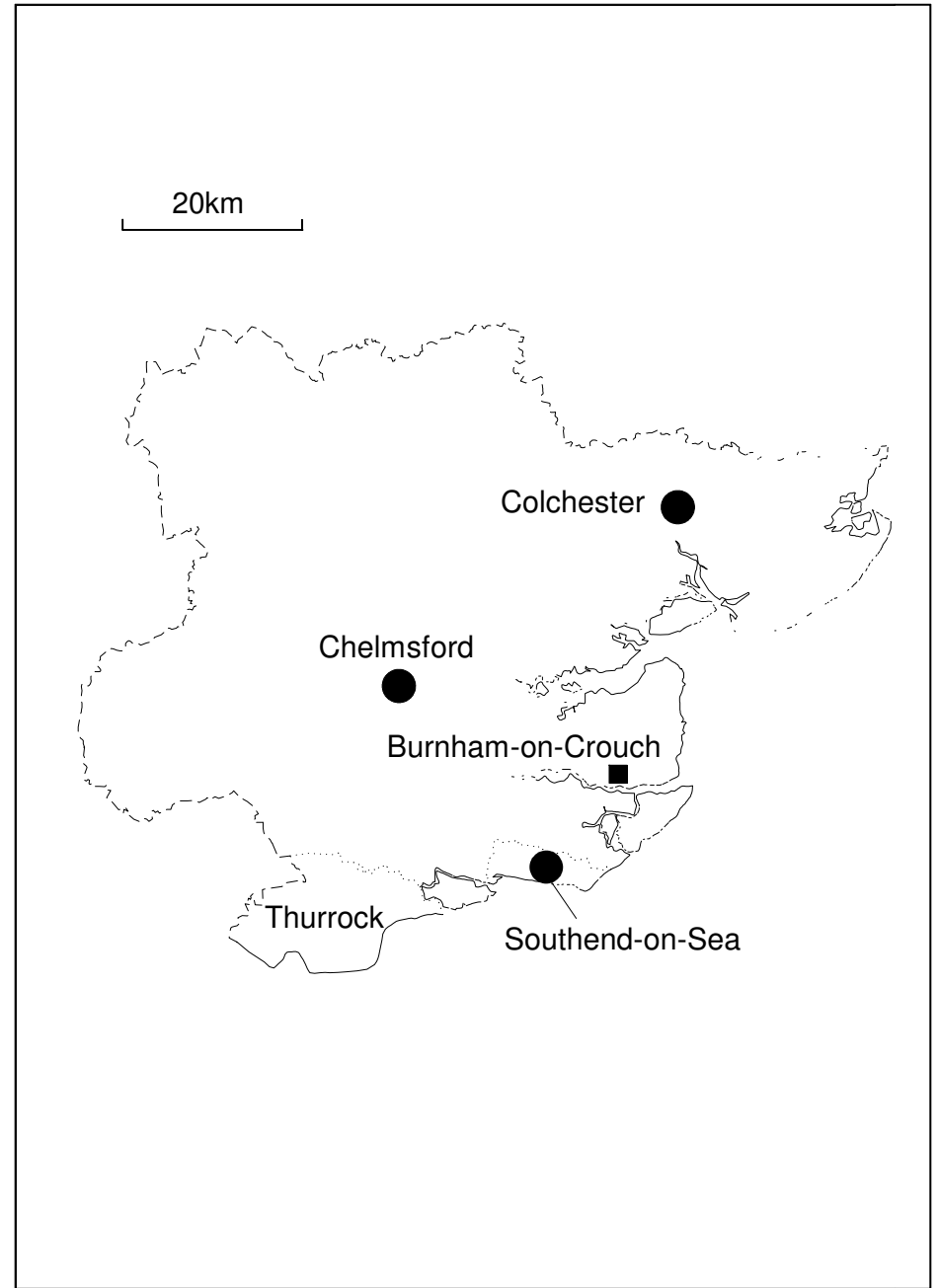
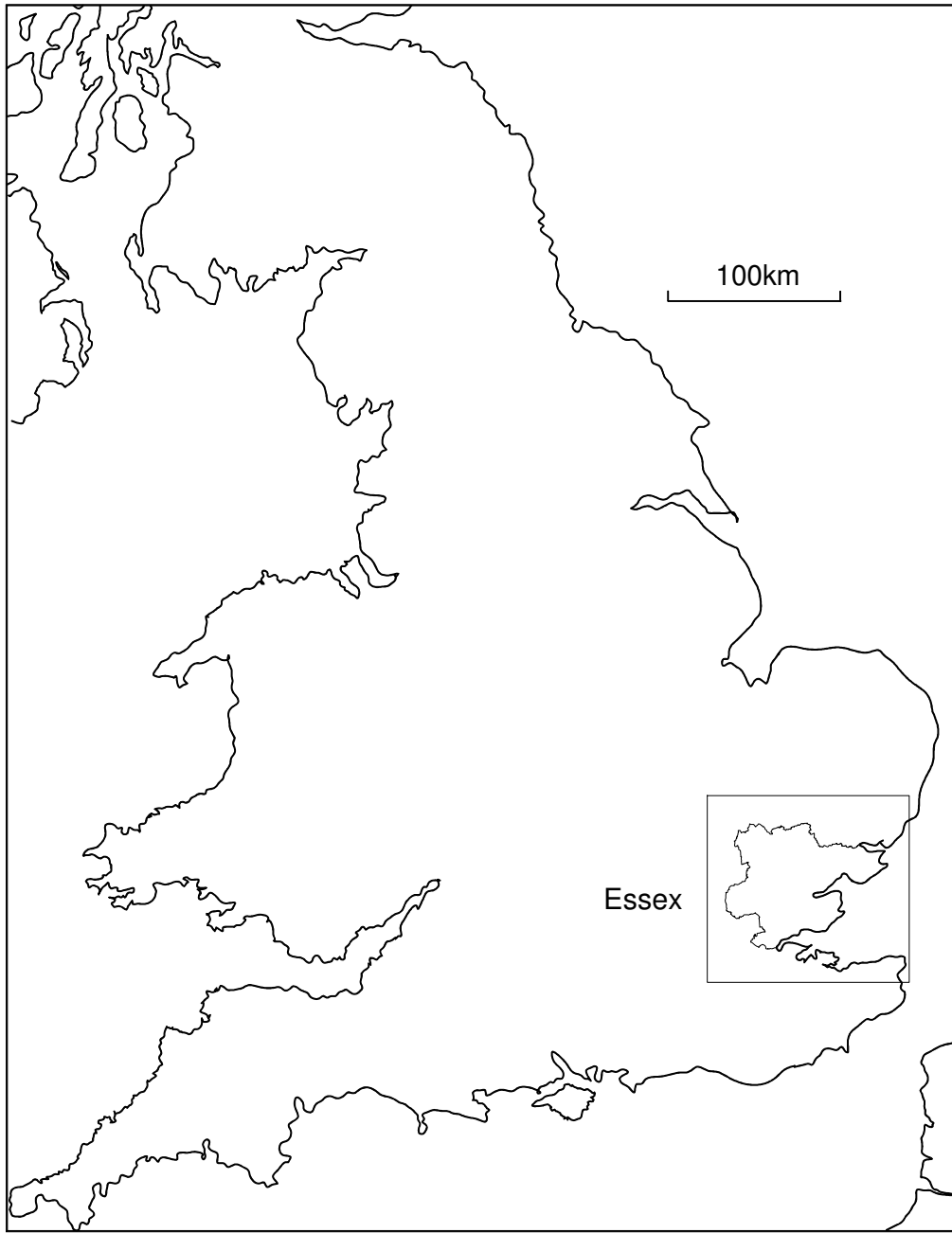


Figure 1: General location plan

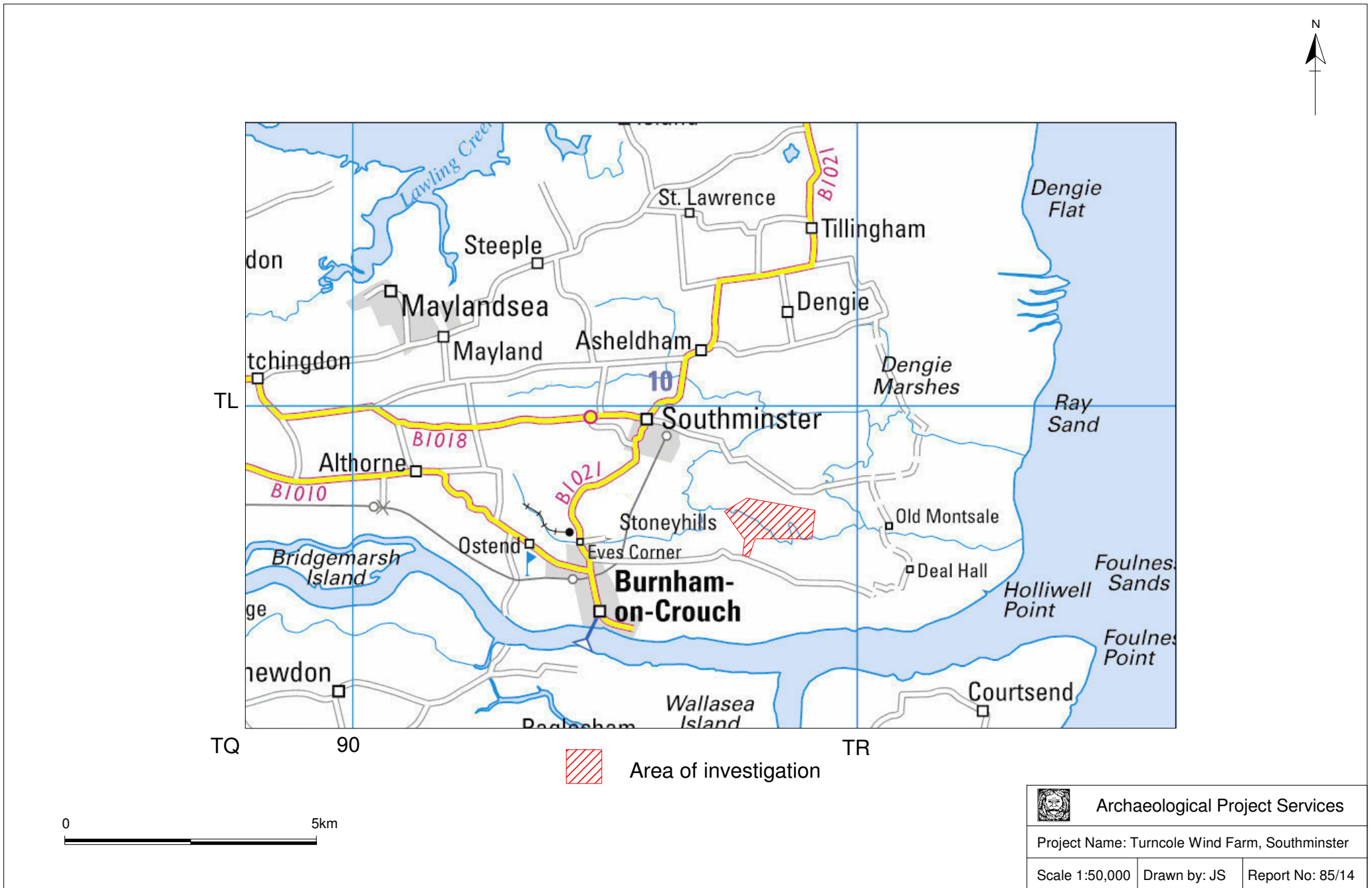


Figure 2 - Site Location

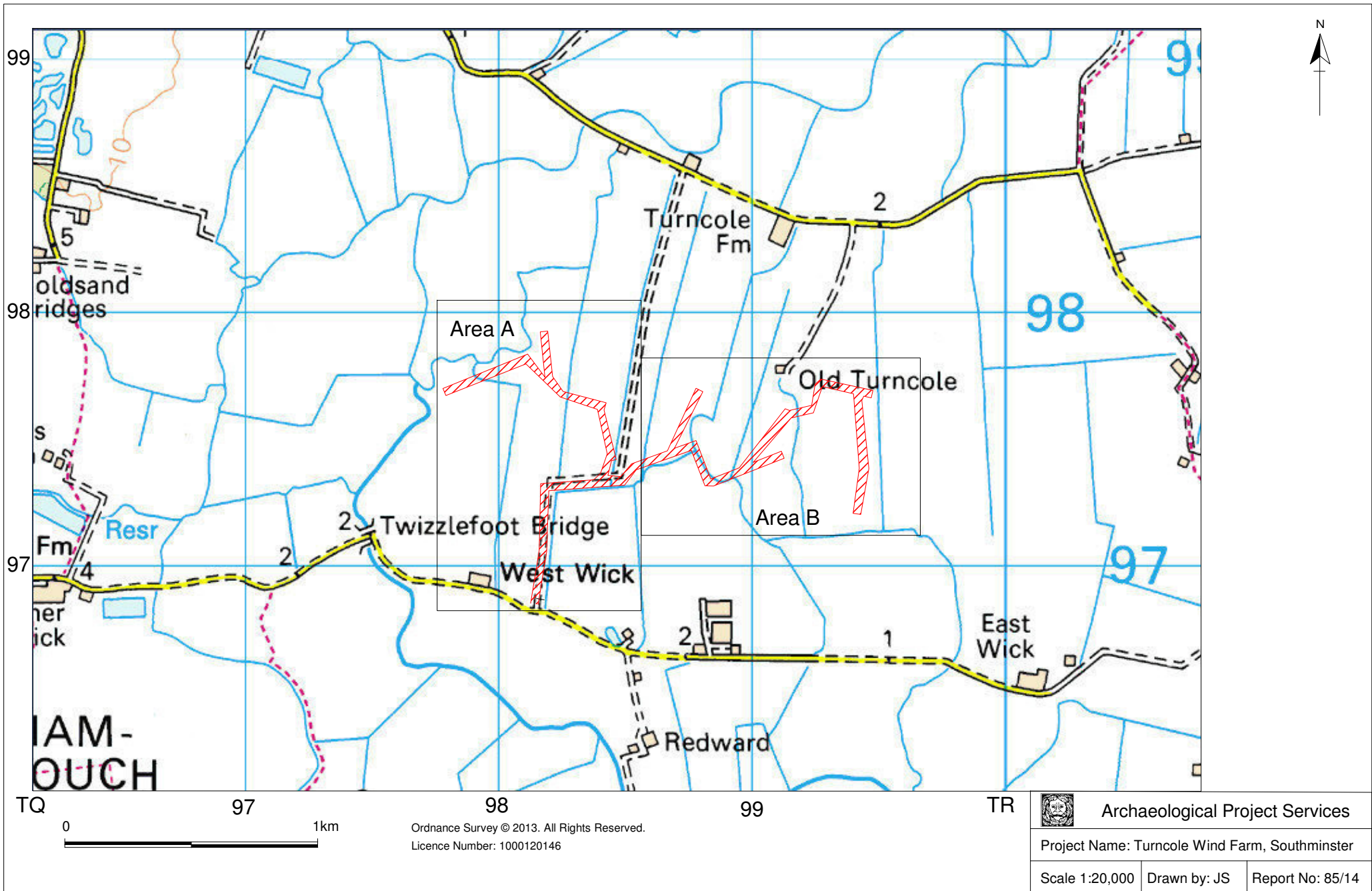


Figure 3 - Site Layout

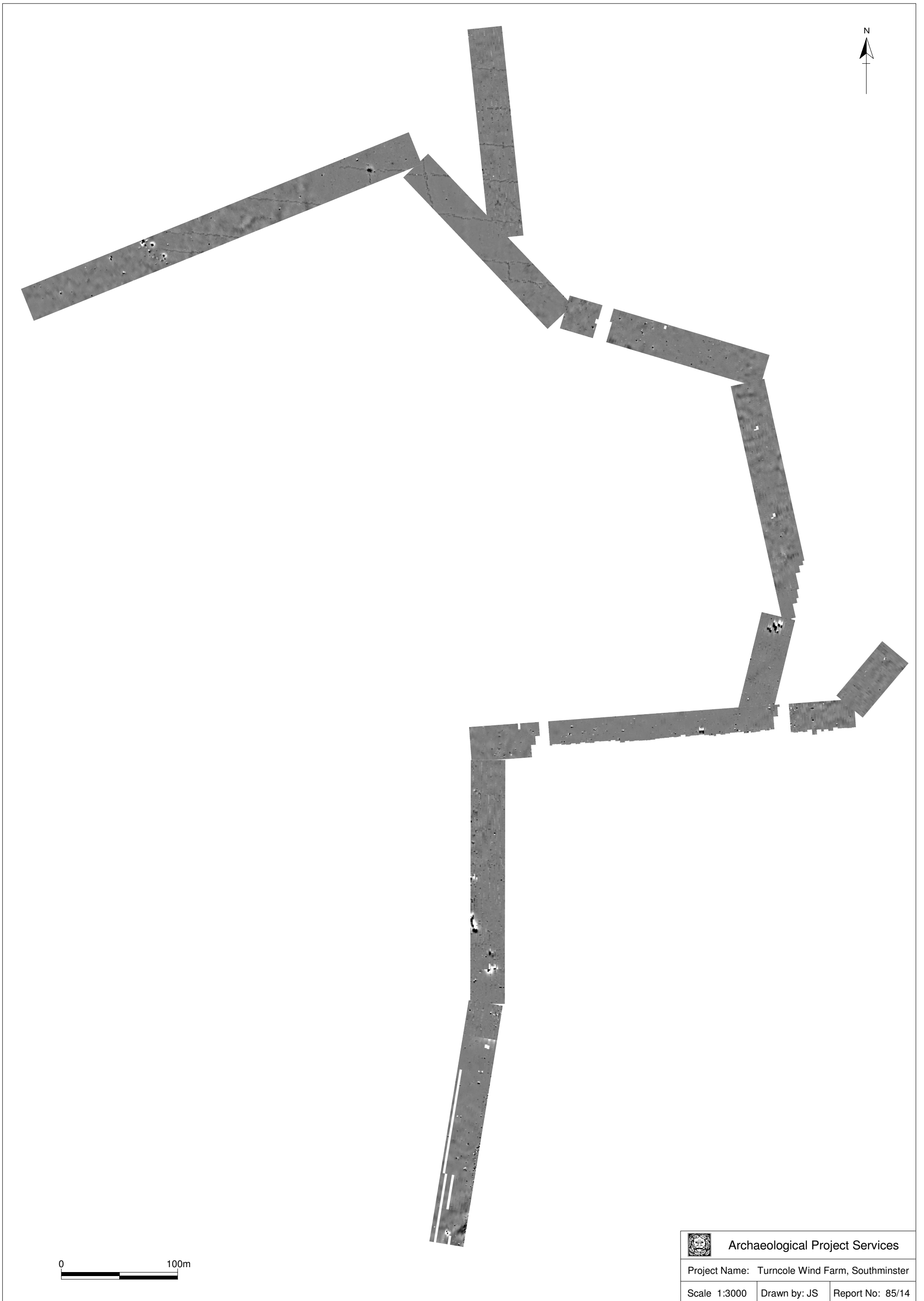
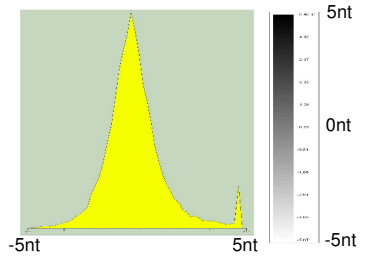


Figure 4 - Minimally processed data greyscale plot



0 100m




	Archaeological Project Services	
Project Name: Turncole Wind Farm, Southminster		
Scale 1:3000	Drawn by: JS	Report No: 85/14

Figure 5 - Processed data greyscale plot Area A

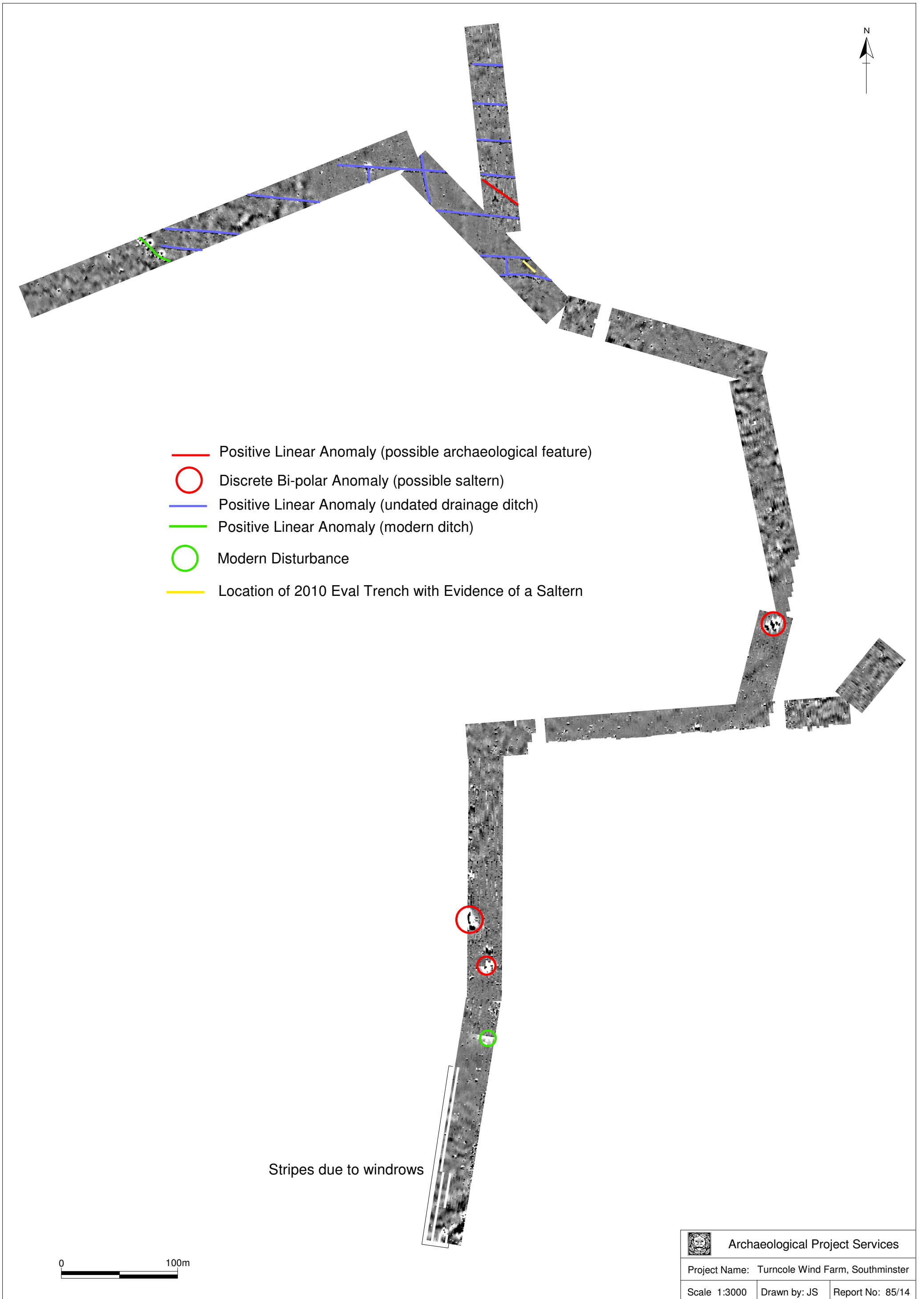
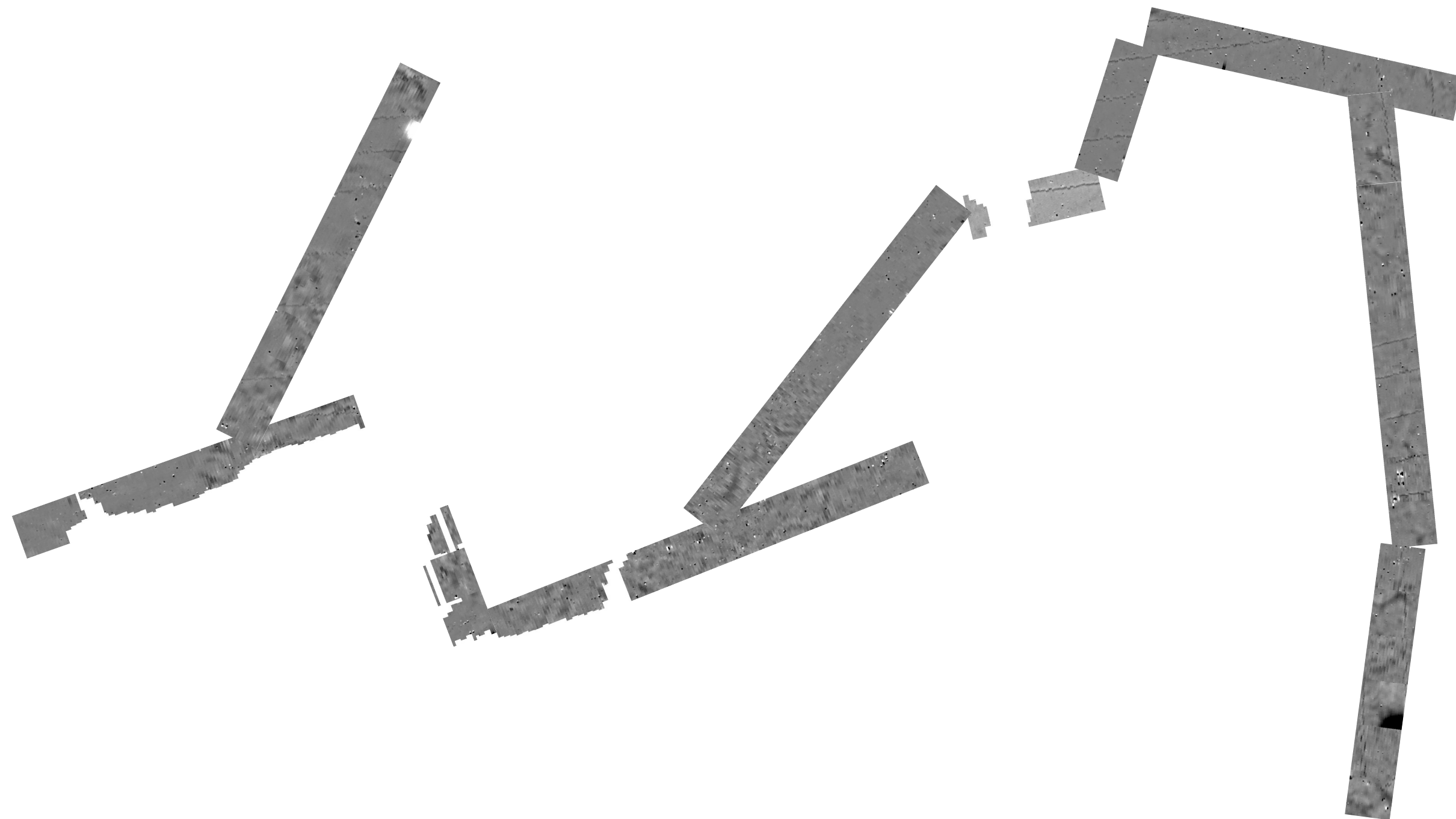


Figure 6 - Interpretive plot, Area A



0 100m


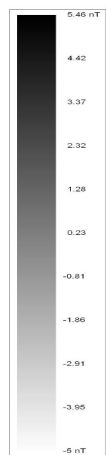
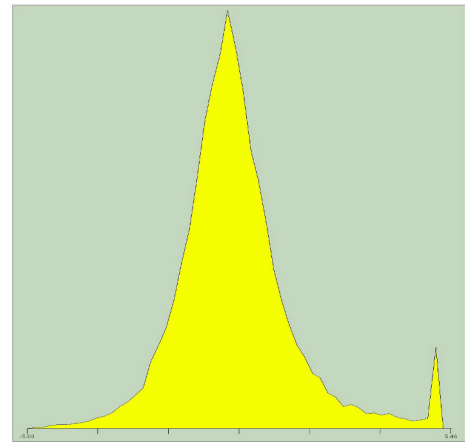
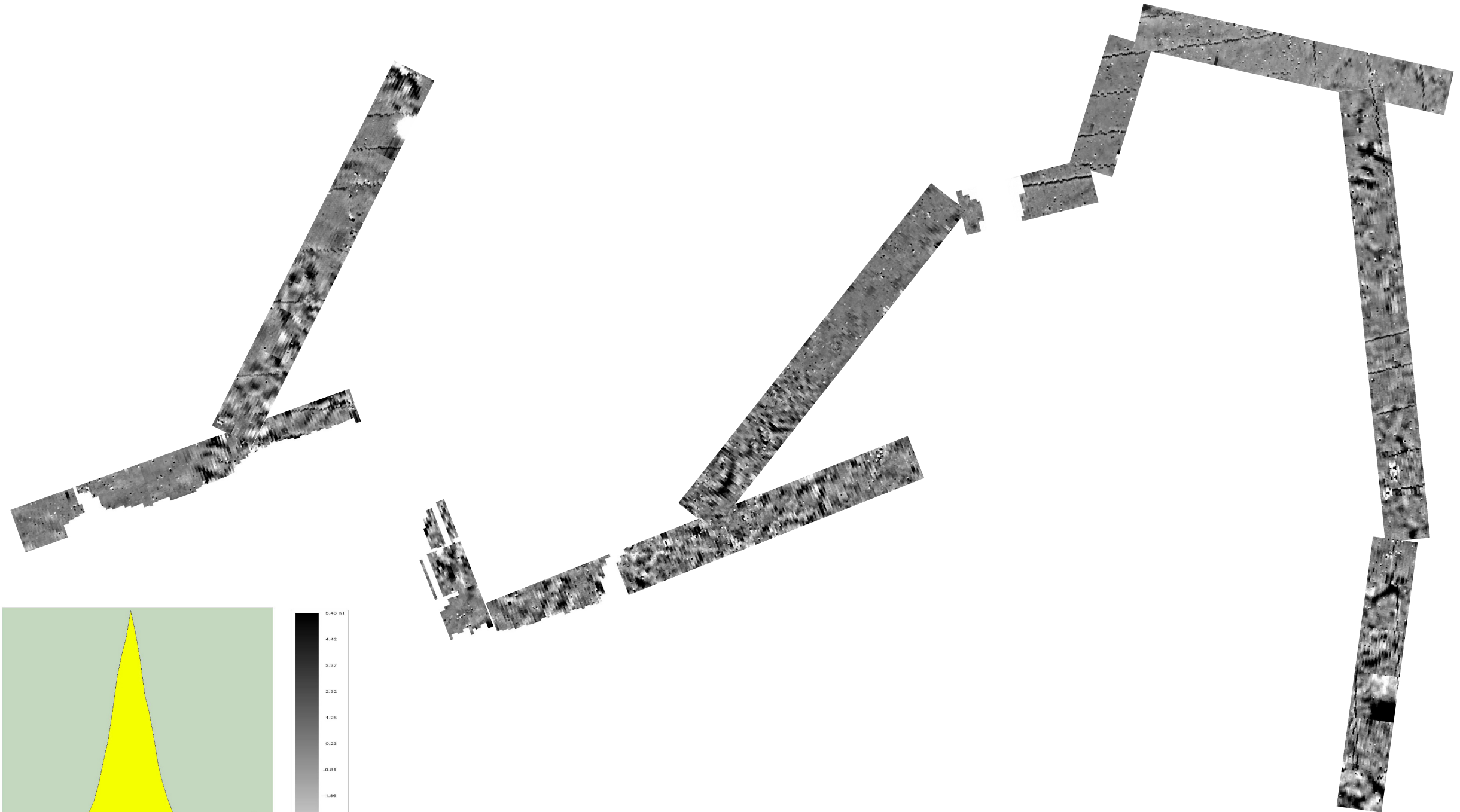
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Project Name:	Turncole Wind Farm, Southminster
Scale:	1:3000
Drawn by:	JS
Report No:	85/14

Figure 7 - Minimmally processed data greyscale plot




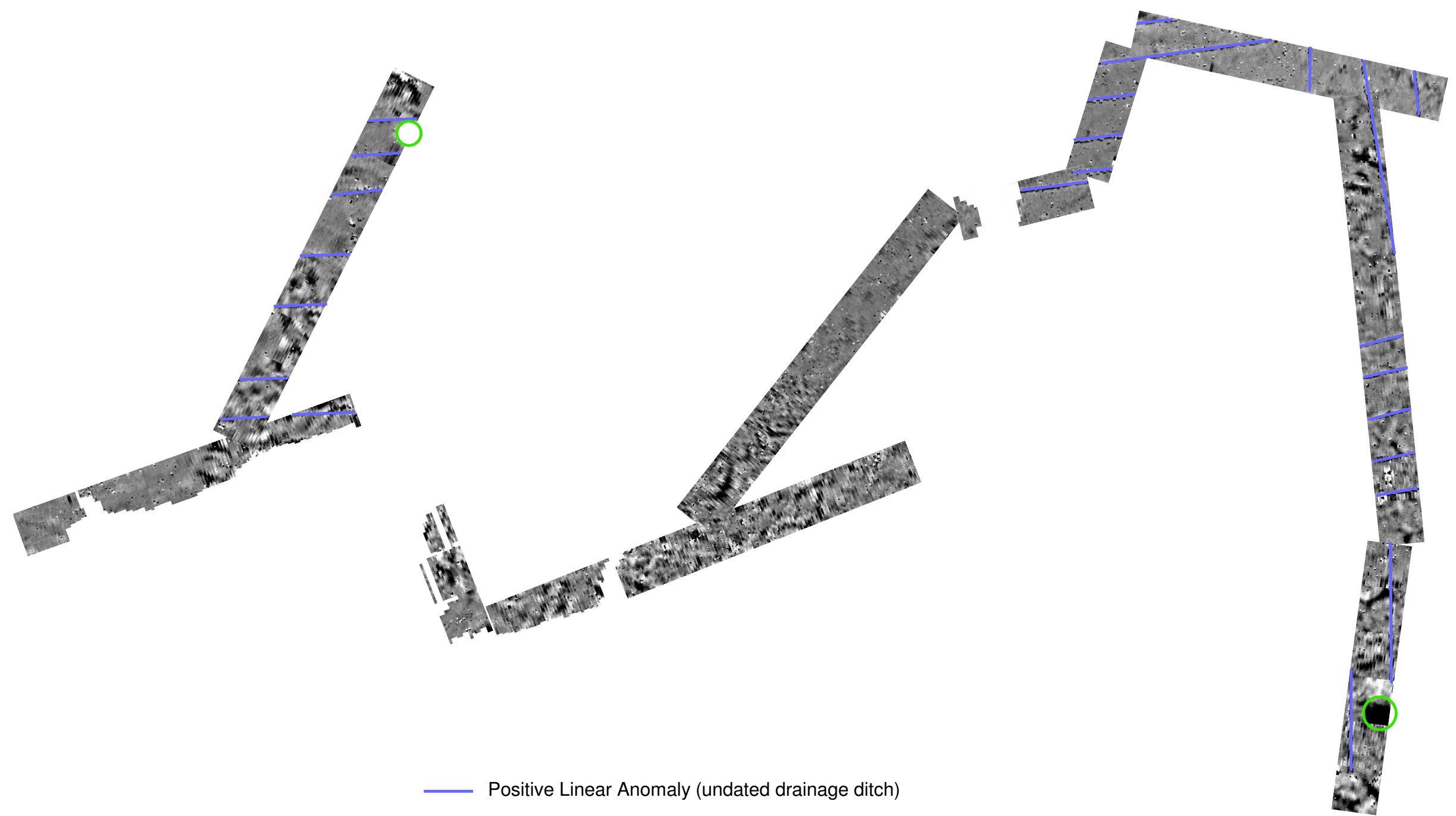


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Project Name:	Turncole Wind Farm, Southminster
Scale:	1:3000
Drawn by:	JS
Report No:	85/14

Figure 8 - Processed Greyscale Plot, Area B



-  Positive Linear Anomaly (undated drainage ditch)
-  Modern Disturbance




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Project Name: Turncole Windfarm, Southminster		
Scale: 1:3000	Drawn by: JS	Report No: 85/14

Figure 9 - Interpreted Greyscale Plot, Area B

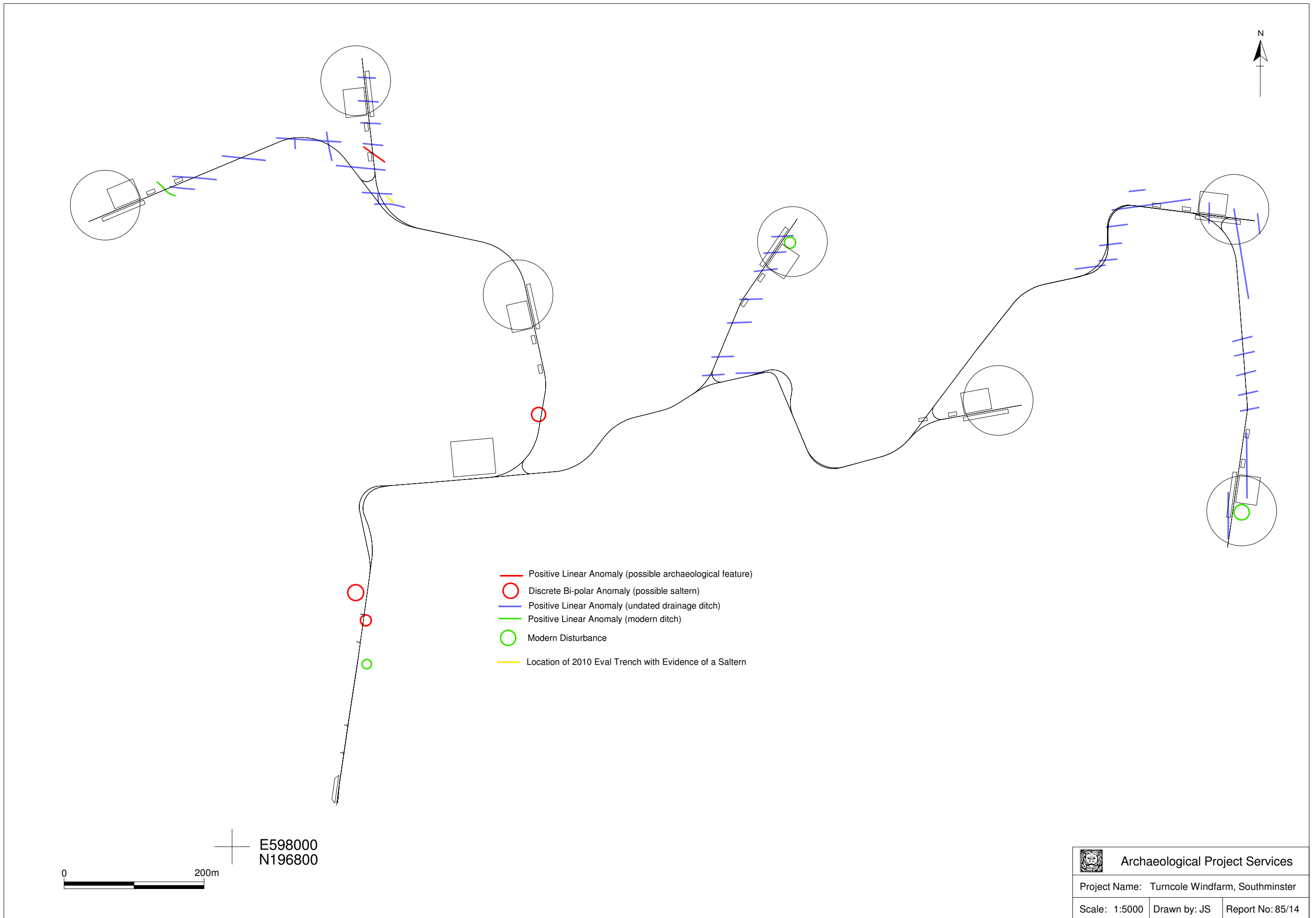


Figure 10 - Identified features and proposed infrastructure

Appendix 1 THE ARCHIVE

The archive consists of:

- 6 Daily record sheets
- 1 Report text and illustrations
- Digital data

File names	SMTW14 A01.xgd to SMTW14 I15.xgd Tran A.xcp to Tran T.xcp
Explanation of codes used in file names	xgd files are magnetometer grids, named with site code and number in the order surveyed. Grids suffixed with '-a' are re-orientated copies. xcp files are composites containing record of all the data and processes used to produce the end product
Description of file formats	All files are in plain text xml format with header data defining survey and processing parameters
List of codes used in files	D indicates a "dummy" value within the composite data
Hardware, software and operating systems	TerraSurveyor 3.0.25.1 running under Windows 7
Date of last modification	08/09/14
Indications of known areas of weakness in data	

All primary records are currently kept at:

Archaeological Project Services, The Old School, Cameron Street, Heckington, Sleaford, Lincolnshire NG34 9RW

Site Code: SMTW14
Accession No: COLEM:2014.74

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OASIS ID: archaeol1-189687

Project details

Project name	Turncole Wind Farm, South Minster, Geophys
Short description of the project	A 12.5ha geophysical survey between Burnham-on-crouch and Southminster
Project dates	Start: 07-08-2014 End: 04-09-2014
Previous/future work	Yes / Not known
Any associated project reference codes	SMTW14 - Sitecode
Any associated project reference codes	Colem:2014.74 - Museum accession ID
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 4 - Character Undetermined
Monument type	DITCH Uncertain
Monument type	SALTERN Roman
Significant Finds	NONE None
Methods & techniques	"Geophysical Survey"
Development type	Wind farm developments
Prompt	Planning condition
Position in the planning process	Not known / Not recorded
Solid geology	Unknown
Drift geology (other)	London Clay overlain by alluvium
Techniques	Magnetometry

Project location

Country	England
Site location	ESSEX MALDON BURNHAM ON CROUCH Turncole Wind Farm
Postcode	CM0 7JJ
Study area	12.50 Hectares

Site coordinates TQ 98556 97956 51.6447425167 0.870169283366 51 38 41 N 000
52 12 E Point

Project creators

Name of Organisation Archaeological Project Services
Project brief originator Archaeological Project Services
Project design originator Denise Drury
Project director/manager Denise Drury
Project supervisor Jonathon Smith
Type of sponsor/funding body Developer
Name of sponsor/funding body RES

Project archives

Physical Archive Exists? No
Digital Archive recipient Colchester Museums
Digital Contents "none"
Digital Media available "Geophysics"
Paper Archive recipient Colchester Museums
Paper Contents "none"
Paper Media available "Diary", "Map", "Miscellaneous Material"

Project bibliography 1

Publication type Grey literature (unpublished document/manuscript)
Title LAND AT TURNCOLE WINDFARM, SOUTH MINSTER, ESSEX.
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