

# EAST FIELD, SOLAR FARM, RUNWAY FARM, PARHAM AIRFIELD, GREAT GLEMHAM, SUFFOLK

### DETAILED MAGNETOMETER SURVEY



Report Number: 1006 January 2013



## EAST FIELD, SOLAR FARM, RUNWAY FARM, PARHAM AIRFIELD, GREAT GLEMHAM, SUFFOLK

#### **Detailed Magnetometer Survey**

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Site Code	GLG 035	NGR	TM 332 608
Planning Ref.	C/12/2067	OASIS	britanni1-141081
Approved By	red By DATE		
	Matthew Adams	January 2013	



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#### **ABSTRACT**

Detailed fluxgate gradiometer survey on the eastern field at Runway Farm, Parham Airfield, Great Glemham, Suffolk was successful in recording four areas of magnetic disturbance of possible archaeological origin, nine dipolar linear trends indicative of ferrous drains laid for the airbase. One strong dipolar linear anomaly demarcates the location of a service pipe run. Isolated Dipolar iron-spike responses were most abundant followed by areas of magnetic disturbance that are likely to relate to buried magnetic rubbish or areas of burning. Five Dipolar Curvi-linear anomalies delimit the former position of aircraft dispersal areas. The majority of the anomalies recorded are of modern origin and relate to the construction and subsequent demolition of the Second World War American Airbase.

#### 1.0 INTRODUCTION

On the 10<sup>th</sup> to the 21<sup>st</sup> December 2012 Britannia Archaeology Ltd (BA) undertook detailed magnetometer survey over 20 hectares of land at on the eastern field at Runway Farm, Parham Airfield, Great Glemham, Suffolk (NGR TM 332 608) in advance of the construction of a Solar Farm. The survey was undertaken on behalf of Adrian French of AGRenewables Ltd, in response to a brief (dated 3<sup>rd</sup> December 2012) prepared by Rachael Monk of Suffolk County Council Archaeology Service/Conservation Team (SCCAS/CT). This survey is part of a programme of archaeological investigations that includes a desk-based assessment, a subsequent geophysical survey on the field to the west and archaeological monitoring on the electricity cable to join the solar array to the National Grid. The weather was sunny in the first week followed by overcast conditions during the second.

#### 2.0 SITE DESCRIPTION

The site is located on a former airfield to the east of New Road in an area dominated by agriculture, to the south-west is Parham Airfield Museum and Great Glemham Wood is present to the east. A farm track that was constructed for the airbase surrounds the majority of the agricultural field which was under short cropped stubble (Figure 1).

The bedrock is described as Crag Group sand, a sedimentary bedrock comprising silicates deposited as mud, silt, sand and gravel formed up to 5 million years ago in the Quaternary and Neogene Periods, where the local environment was dominated by shallow seas (BGS, 2012).

The superficial deposits are Lowestoft Formation Diamicton 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 and outwash sand and gravel from seasonal post glacial melt-waters (BGS, 2012).



#### 2.1 Site Visit 05/12/2012

A site visit was undertaken on the  $5^{th}$  December to assess the ground conditions and to undertake a risk assessment. The fields were found to be suitable for survey with no areas of concern documented.



DP1 East Field Looking North-East



DP2 West Field Looking North-West



#### 3.0 PLANNING POLICIES

The archaeological investigation was carried out on the recommendation of the local planning authority, in consultation with SCCAS/CT, following guidance laid down by the *National Planning and Policy Framework* (NPPF, DCLD 2012) which replaces *Planning Policy Statement 5: Planning for the Historic Environment* (PPS5, DCLG 2010). The relevant local planning policy is the *Suffolk Coastal Local Plan; incorporating First and Second Amendments* (March 2006) which is due to be replaced with the *Suffolk Coastal Local Development Framework* in the near future.

#### 3.1 National Planning Policy Framework (NPPF, DCLG March 2012)

The NPPF recognises that 'heritage assets' are an irreplaceable resource and planning authorities should conserve them in a manner appropriate to their significance when considering development. It requires developers to record and advance understanding of the significance of any heritage assets to be lost (wholly or in part) in a manner proportionate to their importance and the impact, and to make this evidence (and any archive generated) publicly accessible. The key areas for consideration are:

- The significance of the heritage asset and its setting in relation to the proposed development;
- The level of detail should be proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their significance;
- Significance (of the heritage asset) can be harmed or lost through alteration or destruction, or development within its setting. As heritage assets are irreplaceable, any harm or loss should require clear and convincing justification;
- Local planning authorities should not permit loss of the whole or part of a heritage asset without taking all reasonable steps to ensure the new development will proceed after the loss has occurred:
- Non-designated heritage assets of archaeological interest that are demonstrably
  of equivalent significance to scheduled monuments, should be considered subject
  to the policies for designated heritage assets.

#### 3.2 Suffolk Coastal District Council (Policy AP7. 31<sup>st</sup> March 2006)

The local plan for the Suffolk Coastal District deals with development on archaeological sites in section AP7, this states the following:

In considering planning applications, outline or detailed, for development that might affect sites that are known or are likely to contain archaeological remains, the Council will require the following. Where necessary, these should be preceded by a professional archaeological assessment as to the likelihood that remains might be encountered and their importance.

• a field evaluation in those cases where the assessment suggests that important archaeological remains may exist but it is unable to be precise about their nature or extent. The field evaluation shall be carried out by an approved archaeological contractor in accordance with a specification agreed with the Council;



- the preservation of archaeological remains in situ where the assessment and/or field evaluation indicate that the remains are important. Even where lesser remains exist, consideration must be given to the desirability of preserving them in situ:
- adequate arrangements for "preservation by record" a recording of the archaeological remains that would be lost in the course of works for which permission is being sought - in those cases where arguments in favour of the development outweigh the significance of the remains;
- Development that would adversely affect a Scheduled Ancient Monument, its setting or remains will not be permitted.

#### 4.0 ARCHAEOLOGICAL BACKGROUND

Detailed magnetometer survey was undertaken over 20 hectares of agricultural land located in an area of archaeological potential that has never before been archaeologically investigated. Archaeological sites have been recorded both in the County Historic Environment Record (CHER) and also in the recent desk based assessment (Trehy, 2012), within the vicinity of the proposed development area. There are a number of cropmark features (GLG 029, PRK 019) and multi-period findspots (GLG 020, GLG 021). An American Airbase was constructed on the site in May 1942 and later decommissioned in June 1945.

The site has significant potential for the presence of archaeological remains given the number of archaeological sites recorded in the vicinity, the large size of the application area and the fact that no systematic archaeological investigation has so far been undertaken.

#### 5.0 PROJECT AIMS

As per the brief (Section 1.2 Monk, R. 2012) the geophysical survey is required to establish the potential of the site, decisions on the need for any further investigation will be made on the basis of the results of the survey.

#### 6.0 METHODOLOGY

#### 6.1 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. There was a high degree of ground disturbance, probably associated with the demolition of the air base with concrete and rubbish sitting within the topsoil. The surveyors found it fairly difficult to locate a quiet area to zero the machine. Overall the site had a high magnetic background, due to ground disturbance.



#### 6.2 Instrument Calibration

The Magnetometer was left on for a minimum of 20 minutes in the morning for the 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. A set-up station with low magnetic susceptibility was difficult to locate, but this same station was used exclusively throughout the survey to align the sensors providing a common zero point. Sensor drift was noted during the outbreaks of sunshine in the first week, conversely the overcast conditions of the second week allowed the sensors to remain stable.

#### 6.3 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 x 20m grids.

#### 6.4 Survey Grid Location

The survey grid was set out to the Ordnance Survey OSGB36 datum to an accuracy of  $\pm 0.1$ m 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 parallel to the long axis of the field for ease of survey progression (Figure 2).

#### 6.5 Data Capture

Instrument readings were recorded on an internal data logger that was downloaded to a laptop at midday and at the end of each day. The grid order was recorded on a BA proforma to aid in the creation of the composites. Data were filed in job specific folders and broken up into individual day composite datasets. 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 disturbance caused by the concrete track.

#### 6.6 Data Presentation and Processing

The raw corrected greyscale and XY trace plots were of a high enough quality that processed datasets were not required. Corrections allowing the dataset to be viewed in a raw format are shown below.

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

value=mean, replace with = mean;

**Data Clipping**: 1 standard deviation;

**De-stripe:** Traverse, Median, X (Horizontal).

**Data Display:** Clip to -1/+1.



An interpretation plan characterising the anomalies recorded can be found at Figure 6, it draws together the evidence collated from both greyscale and XY trace plots (Figures 3, 4 and 5). All figures were tied into the National Grid and printed to an appropriate scale.

#### 6.7 Software

Raw data was 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.

#### 6.8 Grid Restoration

Britannia Archaeology Ltd positioned three reference stations (orange wooden stakes) in the field (Figure 2) along the baselines, these same stations should be used to relocate the grid and geophysical anomalies.

#### 7.0 PRESENTATION OF RESULTS

The most abundant type of anomaly present throughout the dataset are the isolated dipolar iron-spike responses (Figure 6). These responses demarcate the location of small fragments of magnetic material that have been mixed in with the topsoil during the large scale demolition of farm buildings, the construction of the airbase in the 1940's or the subsequent demolition of the airbase itself. Magnetic debris including metal fragments, brick and concrete were witnessed by the surveyors lying within the topsoil.

Four areas of magnetic disturbance are present within the dataset that may be of archaeological origin. They are likely to have been caused by either large ferrous objects buried in the ploughsoil or possibly by a series of fire events.

Large areas of magnetic disturbance are also abundant in the dataset and are likely to relate to buried ferrous rubbish from when the farms or airbase were demolished.

Nine strong dipolar linear anomalies orientated north-west to south-east and present running perpendicular are believed to be ferrous drains installed during the Second World War.

One strong dipolar linear anomaly aligned approximately east to west to the south of the dataset demarcates the location of a service pipe run.

The most interesting anomalies are the dipolar curvi-linear anomalies (frying-pan shaped) that are present along the eastern border of the site. These relate to aircraft dispersal areas that were used to park planes in widely separated positions to protect them from enemy attack during the Second World War. These responses are comparable in character to the ferrous drains described above, it is possible that similar drains were laid beneath the dispersal areas and still remain *in situ*. The remainder of



the infrastructure linear anomalies demarcate the location of the runways and tracks that are still present bordering the field.

#### 8.0 DISCUSSION & CONCLUSION

A high degree of ground disturbance is evident across the site, causing a relatively high magnetic background. Most of this disturbance was carried out during the construction and subsequent demolition of the American airbase. The majority of anomalies are directly related to the base's construction during the Second World War, the linear anomalies running perpendicular to the field boundaries demarcate the runways and tracks, the curvi-linear anomalies the dispersal areas and perpendicular linear trends relate to the drains.

It would be prudent to target further site investigation work at the four areas of magnetic disturbance to ascertain whether they are indeed of archaeological origin. Although it is also likely that these anomalies are also of modern date.

#### 9.0 ACKNOWLEDGEMENTS

Britannia Archaeology Ltd would like to thank Adrian French of AGRenewables for funding the project.

We are also grateful for the advice of Rachael Monk of SCCAS/CT.

#### 10.0 PROJECT ARCHIVE & 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.



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English Heritage PastScape www.pastscape.org.uk

Heritage Gateway www.heritagegateway.org.uk



Archaeological Data Service (ADS) www.ads.ahds.ac.uk

English Heritage National List for England <a href="https://www.english-heritage.org.uk/professional/protection/process/national-heritage-list-for-england">www.english-heritage.org.uk/professional/protection/process/national-heritage-list-for-england</a>

DEFRA Magic <a href="http://magic.defra.gov.uk/website/magic">http://magic.defra.gov.uk/website/magic</a>



#### Appendix 1 - 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 2 – OASIS Sheet

#### OASIS ID: britanni1-141081

#### **Project details**

**Project name** East Field, Runway Farm, Parham Airfield, Great Glemham, Suffolk

Short description of

the project

Detailed fluxgate gradiometer survey on the eastern field at Runway Farm, Parham Airfield, Great Glemham, Suffolk was successful in recording four areas of magnetic disturbance of possible archaeological origin, nine dipolar linear trends indicative of ferrous drains laid for the airbase. One strong dipolar linear anomaly demarcates the location of a service pipe run. Isolated Dipolar iron-spike responses were most abundant followed by areas of magnetic disturbance that are likely to relate to buried magnetic rubbish or areas of burning. Five Dipolar Curvilinear anomalies delimit the former position of aircraft dispersal areas. The majority of the anomalies recorded are of modern origin and relate to the construction and subsequent demolition of the Second World War

American Airbase.

**Project dates** Start: 10-12-2012 End: 21-12-2012

Previous/future

work

Yes / Yes

Any associated project

reference codes

R1006 - Contracting Unit No.

Any associated project

reference codes

P1017 - Contracting Unit No.

Type of project Field evaluation

Site status None

**Current Land use** Cultivated Land 3 - Operations to a depth more than 0.25m

AIRFIELD DEFENCE SITE Modern Monument type

**Significant Finds** NONE None

Methods & techniques

"Geophysical Survey"

**Development type** Solar Farm

National Planning Policy Framework - NPPF **Prompt** 

Position in the planning process Pre-application

Solid geology

(other)

Crag Group Sand

**Drift geology** 

(other)

Glacial Till, Sands and Gravels

**Techniques** Magnetometry



#### **Project location**

Country England

Site location SUFFOLK, SUFFOLK COASTAL, GREAT GLEMHAM, Runway Farm,

Parham Airfield, Great Glemham

**Postcode IP13 9AF** Study area 20.00 Hectares

Site coordinates TM 332 608 52 1 52 11 43 N 001 24 45 E Point

Height OD / Depth Min: 38.00m Max: 40.00m

**Project creators** 

Name of Organisation

Britannia Archaeology Ltd

**Project brief** originator

Local Authority Archaeologist and/or Planning Authority/advisory body

Project design originator

Timothy Schofield

**Project** 

director/manager

Timothy Schofield

Matthew Adams **Project supervisor** 

Type of sponsor/funding

body

Developer

Name of sponsor/funding

body

**AGRenewables** 

**Project archives** 

**Physical Archive** 

Exists?

No

**Digital Archive** 

recipient

Suffolk HER

"Survey"

**Digital Contents** 

**Digital Media** available

"Geophysics"

**Paper Archive** 

recipient

Suffolk HER

**Paper Contents** 

"Survey"

Paper Media available

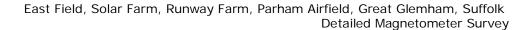
"Map", "Plan", "Report", "Survey ", "Unpublished Text"

**Project** 

bibliography 1

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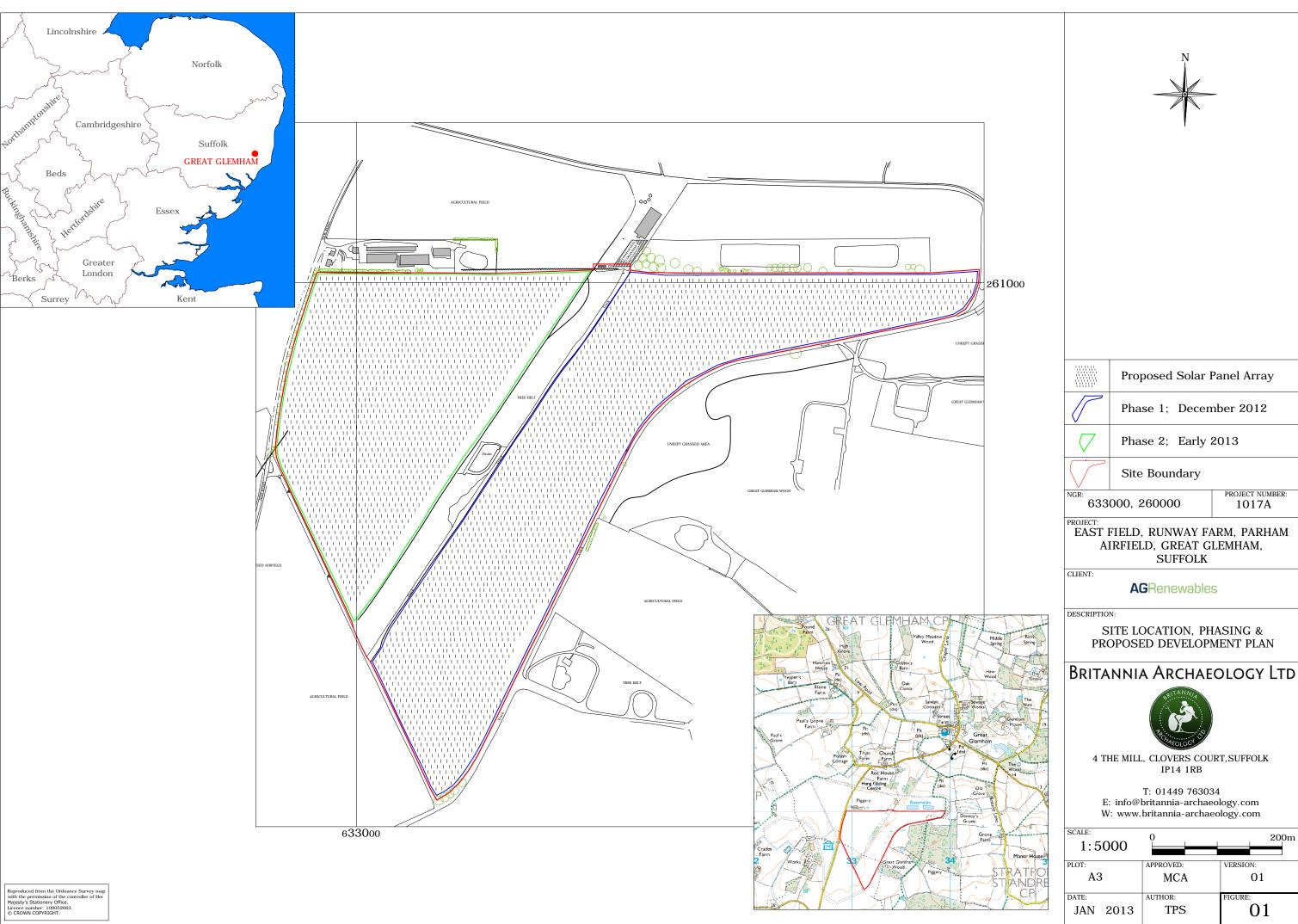
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11111111 11111111	Proposed Solar Panel Array			
	Phase 1; Decen	nber 2012		
	Phase 2; Early 2013			
	Site Boundary			
NGR:		PROJECT NUMBER:		

E: info@britannia-archaeology.com

SCALE: 1:5000	0	200m
PLOT:	APPROVED:	VERSION:
A3	MCA	01
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