

GEOPHYSICAL SURVEY REPORT

# STRATASCAN™



Project name:  
**Vearse Farm, Bridport, Dorset**

Client:  
**Hallam Land**

**June 2015**

Job ref:  
**J8488**

Report author:  
**Rebecca Davies BSc (Hons)**

# GEOPHYSICAL SURVEY REPORT

Project name:

**Vearse Farm, Bridport, Dorset**

Client:

**Hallam Land**



Job ref:

**J8488**

Techniques:

**Detailed magnetic survey –  
Gradiometry**

Survey date:

**3rd - 11th June 2015**

Site centred at:

**SY 454 275**

Post code:

**DT6 5BW**

Field team:

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## 1 SUMMARY OF RESULTS

A detailed gradiometry survey was conducted over approximately 27 hectares of mixed arable farmland and grassland. A probable former medieval field system has been identified, supporting information from the HER search, and indicates that the site has an agricultural past. Former field boundaries and weak evidence of ridge and furrow provide further evidence of the site being used for agricultural purposes since the medieval period. Possible backfilled pits and linear anomalies may be of archaeological origin, though this cannot be determined with confidence. The remaining features are natural or modern and include evidence of ploughing, land drains, services, scattered magnetic debris and disturbance from nearby ferrous objects.

## 2 INTRODUCTION

### 2.1 *Background synopsis*

Stratascan were commissioned to undertake a geophysical survey of an area outlined for residential development. This survey forms part of an archaeological investigation being undertaken by Hallam Land.

### 2.2 *Site location*

The site is located to the west of Bridport, Dorset at OS ref. SY 454 275.

### 2.3 *Description of site*

The survey area is approximately 33 hectares of undulating grassland and arable farmland. An area of approximately 6 hectares could not be surveyed due to wheat crop and areas of overgrown vegetation, reducing the total area surveyed to approximately 27 hectares.

### 2.4 *Geology and soils*

The underlying geology is interbedded siltstone and limestone of Eype Clay Member (British Geological Survey website). Superficial deposits of Alluvium – clay, silt, sand and gravel, are recorded across the north east of the site (British Geological Survey website).

The overlying soils are known as Curtisden which are typical stagnogleyic argillc brown earths. These consist of silty soils over siltstone with slowly permeable subsoils and slight seasonal waterlogging (Soil Survey of England and Wales, Sheet 5 South West England).

## 2.5 ***Site history and archaeological potential***

A search of Dorset Historic Environment Record (Dorset County Council, 2015) within a 1km radius of the site has identified a number of medieval and post-medieval agricultural and industrial remains.

The remains of medieval strip lynchets (HER No. 1 002 004) are recorded immediately north of the site on the south slope of Allington Hill. These are comprised of two pronounced parallel strip lynchets following the contours of the hillside, and are thought to form part of a medieval/post-medieval field system.

The former Gummer's Twine manufactory, directly north of West Road, north of the site, was established in 1783 and operated as a ropery until 1809 when it was converted into the Grove Iron Foundry.

The site of a possible post-medieval well (HER No. WX2842) is recorded at Vearse Farm, as well a number of linear earthworks (HER No. MDO28566) which are comprised of earth bank with stone cores. It is thought that these are related to post-medieval constructed hedgerows and field boundaries.

Given the close proximity of medieval strip lynchets to the site, it could be determined that the site has a moderate potential for medieval agricultural remains and a high potential for post-medieval remains.

## 2.6 ***Survey objectives***

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

## 2.7 ***Survey methods***

This report and all fieldwork have been conducted in accordance with both the English Heritage guidelines outlined in the document: *Geophysical Survey in Archaeological Field Evaluation, 2008* and with the Chartered Institute for Archaeologists document *Standard and Guidance for Archaeological Geophysical Survey*.

Due to the moderate potential for identifying medieval agricultural remains, detailed magnetic survey (gradiometry) was used as an efficient and effective method of locating archaeological anomalies. More information regarding this technique is included in Appendix A.

## 2.8 ***Processing, presentation and interpretation of results***

### 2.8.1 *Processing*

Processing is performed using specialist 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. 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 minimally processed gradiometer data used in this report:

1. *Destripe* (Removes striping effects caused by zero-point discrepancies between different sensors and walking directions)
2. *Destagger* (Removes zigzag effects caused by inconsistent walking speeds on sloping, uneven or overgrown terrain)

### 2.8.2 Presentation of results and interpretation

The presentation of the data for each site involves a print-out of the minimally processed data both as a greyscale plot and a colour plot showing extreme magnetic values. Magnetic anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawing for the site.

## 3 RESULTS

The detailed magnetic gradiometer survey conducted at Vearse Farm, Bridport has identified a number of anomalies that have been characterised as being either of a *probable* or *possible* archaeological origin.

The difference between *probable* and *possible* archaeological origin is a confidence rating. Features identified within the dataset that form recognisable archaeological patterns or seem to be related to a deliberate historical act have been interpreted as being of a probable archaeological origin.

Features of possible archaeological origin tend to be more amorphous anomalies which may have similar magnetic attributes in terms of strength or polarity but are difficult to classify as being archaeological or natural.

The following list of numbered anomalies refers to numerical labels on the interpretation plots.

### 3.1 Probable Archaeology

- 1 A number of positive linear anomalies in the north of the site. These are indicative of former cut features of probable archaeological origin.
- 2 Positive linear anomalies in the east of the site. The triangular feature is likely to be an enclosure, and may be related to the field system visible in Anomaly 5.

### 3.2 *Possible Archaeology*

- 3 A small number of positive linear anomalies in the west and east of the site. These are indicative of former cut features, such as ditches, and may be of archaeological or agricultural origin.
- 4 Small discrete positive anomalies in the north and east of the site. These are indicative of small former cut features, such as backfilled pits, and may be archaeological or natural in origin.

### 3.3 *Medieval/Post-Medieval Agriculture*

- 5 A number of positive linear anomalies across the site. These are likely to represent a field system of medieval or post-medieval date as they do not correspond with the current field boundaries.
- 6 A linear anomaly near the centre of the site. This is related to a former field boundary that is visible on available historic mapping from 1888 to 1890.
- 7-9 A number of linear anomalies in the north-west, centre and south of the site. These are related to former field boundaries that are visible on available historic mapping from 1888 to 1976.
- 9a-10 Two areas of scattered magnetic debris in the south of the site. These are related to former field boundaries visible on available historic mapping from 1888 to 1976.
- 11 A small number of linear anomalies in the west and north of the site. Due to their alignment with modern field boundaries, these are likely to be related to former field boundaries that are not visible on available historic mapping.
- 12 Widely spaced parallel linear anomalies in the north, east and south-east of the site. These are related to ridge and furrow cultivation.
- 13 A linear anomaly in the east of the site. This is related to modern agricultural activity, such as ploughing.

### 3.4 *Other Anomalies*

- 14 A number of areas of amorphous magnetic variation across the site. These are likely to be natural, i.e. geological, in origin.



- 15 A number of strong bipolar linear anomalies in the south and centre of the site. These are related to modern underground services, such as pipes.
- 16 A number of areas of scattered magnetic debris across the site. These are likely to be modern in origin.
- 17 A small number of weak bipolar linear anomalies in the south-east of the site. These are related to land drains.
- 18 Areas of magnetic disturbance are the result of substantial nearby ferrous metal objects such as fences and underground services. These effects can mask weaker archaeological anomalies, but on this site have not affected a significant proportion of the area.
- 19 A number of magnetic 'spikes' (strong focussed values with associated antipolar response) indicate ferrous metal objects. These are likely to be modern rubbish.

#### 4 DATA APPRAISAL & CONFIDENCE ASSESSMENT

Jurassic limestone and siltstone geologies, such as those of Eype Clay Formation generally give good response for gradiometer survey. The alluvial deposits in the north-east of the site have the potential to mask weaker archaeological features, therefore it is not possible to say with confidence that all anomalies will have been detected in this area. Despite this, several features of archaeological origin, as well as field boundaries and evidence of ridge and furrow cultivation, indicate that the survey has been effective.

#### 5 CONCLUSION

The survey at Vearse Farm, Bridport has identified a number of features of probable and possible archaeological origin. Given the close proximity of the site to medieval strip lynchets, identified through a search of Dorset HER, the linear anomalies discovered across the site are likely to be related to form part of a wider, multi-phase, field system. The triangular enclosure and linear anomalies in the north of the site are likely to be contemporary with the field system due to their similar orientations. Weak evidence of ridge and furrow cultivation and former field boundaries provide further evidence of the site having a largely agricultural past. Additional linear anomalies and possible former backfilled pits may be of archaeological origin, though their exact origin cannot be determined with any degree of confidence.

The remaining features are natural or modern in origin and include land drains, underground services, evidence of ploughing, scattered magnetic debris and magnetic disturbance from nearby ferrous metal objects such as fencing.

## 6 REFERENCES

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## APPENDIX A – METHODOLOGY & SURVEY EQUIPMENT

### ***Grid locations***

The location of the survey grids has been plotted together with the referencing information. Grids were set out using a Leica 705auto Total Station and referenced to suitable topographic features around the perimeter of the site or a Leica Smart Rover RTK GPS.

An RTK GPS (Real-time Kinematic Global Positioning System) can locate a point on the ground to a far greater accuracy than a standard GPS unit. A standard GPS suffers from errors created by satellite orbit errors, clock errors and atmospheric interference, resulting in an accuracy of 5m-10m. An RTK system uses a single base station receiver and a number of mobile units. The base station re-broadcasts the phase of the carrier it measured, and the mobile units compare their own phase measurements with those they received from the base station. A SmartNet RTK GPS uses Ordnance Survey's network of over 100 fixed base stations to give an accuracy of around 0.01m.

### ***Survey equipment and gradiometer configuration***

Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.2 nanoTeslas (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 instrument consists of two fluxgates very accurately aligned to nullify the effects of the Earth's magnetic field. Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background. The Grad601-2 consists of two high stability fluxgate gradiometers suspended on a single frame. Each gradiometer has a 1m separation between the sensing elements so enhancing the response to weak anomalies.

### ***Sampling interval***

Readings were taken at 0.25m centres along traverses 1m apart. This equates to 3600 sampling points in a full 30m x 30m grid.

### ***Depth of scan and resolution***

The Grad 601-2 has a typical depth of penetration of 0.5m to 1.0m, though strongly magnetic objects may be visible at greater depths. The collection of data at 0.25m centres provides an optimum methodology for the task balancing cost and time with resolution.

### ***Data capture***

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 site survey, data is transferred to the office for processing and presentation.

## APPENDIX B – BASIC PRINCIPLES OF MAGNETIC SURVEY

Detailed magnetic survey can be used to effectively define areas of past human activity by mapping spatial variation and contrast in the magnetic properties of soil, subsoil and bedrock.

Weakly magnetic iron minerals are always present within the soil and areas of enhancement relate to increases in *magnetic susceptibility* and permanently magnetised *thermoremanent* material.

Magnetic susceptibility relates to the induced magnetism of a material when in the presence of a magnetic field. This magnetism can be considered as effectively permanent as it exists within the Earth's magnetic field. Magnetic susceptibility can become enhanced due to burning and complex biological or fermentation processes.

Thermoremanence is a permanent magnetism acquired by iron minerals that, after heating to a specific temperature known as the Curie Point, are effectively demagnetised followed by re-magnetisation by the Earth's magnetic field on cooling. Thermoremanent archaeological features can include hearths and kilns and material such as brick and tile may be magnetised through the same process.

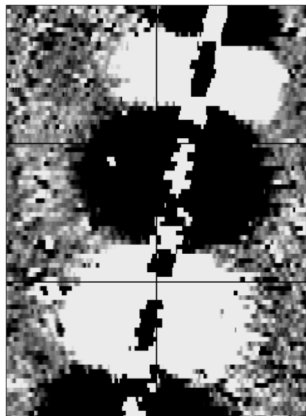
Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement allowing assessment and characterisation of subsurface features. Material such as subsoil and non-magnetic bedrock used to create former earthworks and walls may be mapped as areas of lower enhancement compared to surrounding soils.

Magnetic survey is carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field whilst the lower sensor measures the same field but is also more affected by any localised buried field. The difference between the two sensors will relate to the strength of a magnetic field created by a buried feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity, disturbance from modern services etc.

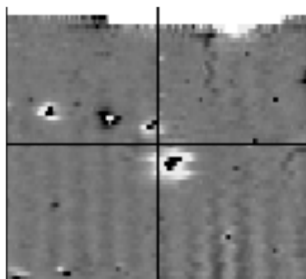
## APPENDIX C – GLOSSARY OF MAGNETIC ANOMALIES

### Bipolar



A bipolar anomaly is one that is composed of both a positive response and a negative response. It can be made up of any number of positive responses and negative responses. For example a pipeline consisting of alternating positive and negative anomalies is said to be bipolar. See also dipolar which has only one area of each polarity. The interpretation of the anomaly will depend on the magnitude of the magnetic field strength. A weak response may be caused by a clay field drain while a strong response will probably be caused by a metallic service.

### Dipolar

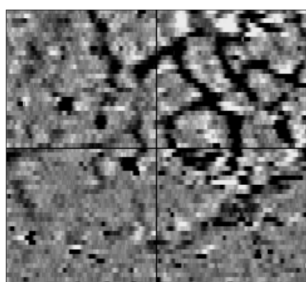


This consists of a single positive anomaly with an associated negative response. There should be no separation between the two polarities of response. These responses will be created by a single feature. The interpretation of the anomaly will depend on the magnitude of the magnetic measurements. A very strong anomaly is likely to be caused by a ferrous object.

### Positive anomaly with associated negative response

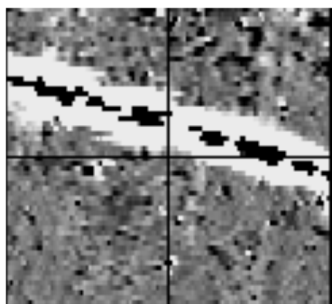
See bipolar and dipolar.

### Positive linear



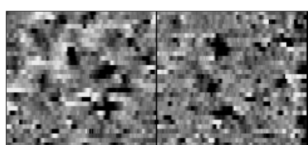
A linear response which is entirely positive in polarity. These are usually related to in-filled cut features where the fill material is magnetically enhanced compared to the surrounding matrix. They can be caused by ditches of an archaeological origin, but also former field boundaries, ploughing activity and some may even have a natural origin.

### Positive linear anomaly with associated negative response



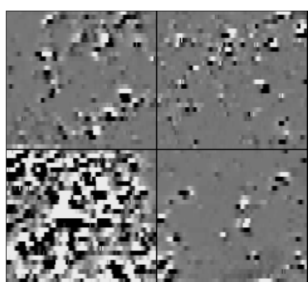
A positive linear anomaly which has a negative anomaly located adjacently. This will be caused by a single feature. In the example shown this is likely to be a single length of wire/cable probably relating to a modern service. Magnetically weaker responses may relate to earthwork style features and field boundaries.

### Positive point/area



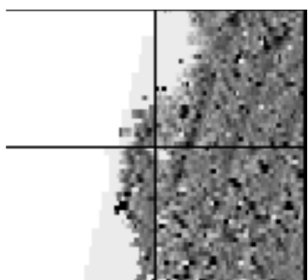
These are generally spatially small responses, perhaps covering just 3 or 4 reading nodes. They are entirely positive in polarity. Similar to positive linear anomalies they are generally caused by in-filled cut features. These include pits of an archaeological origin, possible tree bowls or other naturally occurring depressions in the ground.

### Magnetic debris



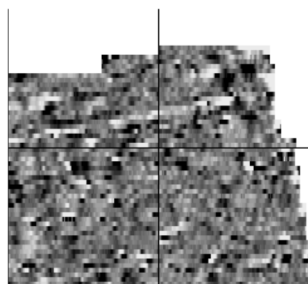
Magnetic debris consists of numerous dipolar responses spread over an area. If the amplitude of response is low ( $\pm 3nT$ ) then the origin is likely to represent general ground disturbance with no clear cause, it may be related to something as simple as an area of dug or mixed earth. A stronger anomaly ( $\pm 250nT$ ) is more indicative of a spread of ferrous debris. Moderately strong anomalies may be the result of a spread of thermoremanent material such as bricks or ash.

### Magnetic disturbance



Magnetic disturbance is high amplitude and can be composed of either a bipolar anomaly, or a single polarity response. It is essentially associated with magnetic interference from modern ferrous structures such as fencing, vehicles or buildings, and as a result is commonly found around the perimeter of a site near to boundary fences.

### Negative linear

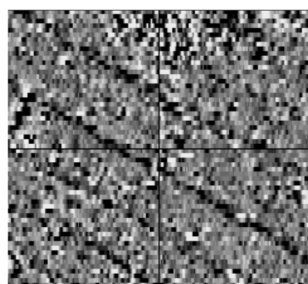


A linear response which is entirely negative in polarity. These are generally caused by earthen banks where material with a lower magnetic magnitude relative to the background top soil is built up. See also ploughing activity.

### Negative point/area

Opposite to positive point anomalies these responses may be caused by raised areas or earthen banks. These could be of an archaeological origin or may have a natural origin.

### Ploughing activity



Ploughing activity can often be visualised by a series of parallel linear anomalies. These can be of either positive polarity or negative polarity depending on site specifics. It can be difficult to distinguish between ancient ploughing and more modern ploughing. Clues such as the separation of each linear, straightness, strength of response and cross cutting relationships can be used to aid this, although none of these can be guaranteed to differentiate between different phases of activity.

### Polarity

Term used to describe the measurement of the magnetic response. An anomaly can have a positive polarity (values above 0nT) and/or a negative polarity (values below 0nT).

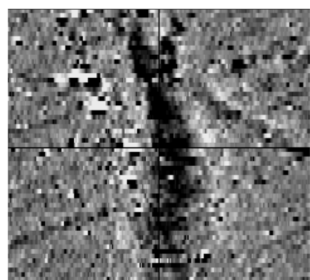
### Strength of response

The amplitude of a magnetic response is an important factor in assigning an interpretation to a particular anomaly. For example a positive anomaly covering a 10m<sup>2</sup> area may have values up to around 3000nT, in which case it is likely to be caused by modern magnetic interference. However, the same size and shaped anomaly but with values up to only 4nT may have a natural origin. Colour plots are used to show the amplitude of response.

### Thermoremanent response

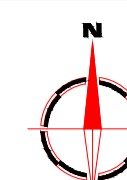
A feature which has been subject to heat may result in it acquiring a magnetic field. This can be anything up to approximately +/-100 nT in value. These features include clay fired drains, brick, bonfires, kilns, hearths and even pottery. If the heat application has occurred in situ (e.g. a kiln) then the response is likely to be bipolar compared to if the heated objects have been disturbed and moved relative to each other, in which case they are more likely to take an irregular form and may display a debris style response (e.g. ash).

### Weak background variations



Weakly magnetic wide scale variations within the data can sometimes be seen within sites. These usually have no specific structure but can often appear curvy and sinuous in form. They are likely to be the result of natural features, such as soil creep, dried up (or seasonal) streams. They can also be caused by changes in the underlying geology or soil type which may contain unpredictable distributions of magnetic minerals, and are usually apparent in several locations across a site.





Amendments

Issue No.	Date	Description
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-	-	-

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Site centred on NGR SY 454 275

OS REFERENCING INFORMATION

A	345181.24, 92819.63
B	345331.24, 92819.63
C	345181.24, 92639.63
D	345331.24, 92639.63
E	345451.24, 92939.63
F	345451.24, 92819.63
G	345421.24, 92759.63
H	345421.24, 92609.63
I	345541.24, 92789.63
J	345541.24, 92669.63
K	345541.24, 92579.63
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M	345571.24, 92849.63
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V	345601.24, 92429.63
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X	345751.24, 92429.63

Job No.	8488	Survey Date	JUN 15
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Client  
**HALLAM LAND**

Project Title  
**GEOPHYSICAL SURVEY -  
VEARSE FARM, BRIDPORT,  
DORSET**

Subject  
**SITE LOCATION, SURVEY  
AREA & REFERENCING**

**STRATASCAN™**  
GEOPHYSICS FOR ARCHAEOLOGY  
AND ENGINEERING

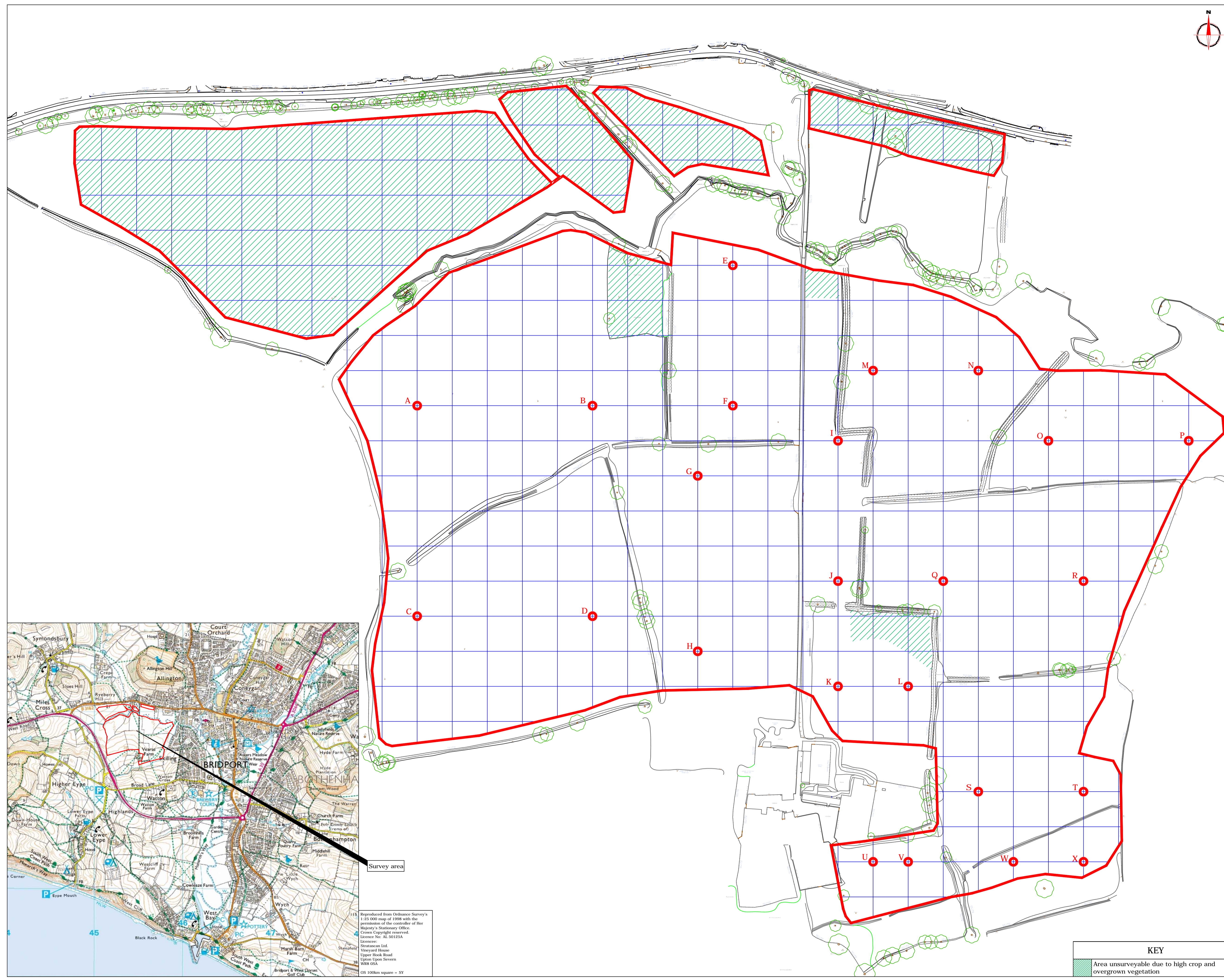
VINEYARD HOUSE T: 01684 592266  
UPTON UPON SEVERN E: info@stratascan.co.uk  
WR8 0SA www.stratascan.co.uk

**GPR ASSOCIATION**

**SUMO** SUMO GROUP MEMBER  
ISO 9001 certified  
ISO 14001 certified

Scale  
1:1500

Plot	A1	Checked by	PPB	Issue No.	01
Date	JUN 15	Drawn by	RD	Figure No.	01



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Upper Hook Road  
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OS 100km square = SY

**KEY**

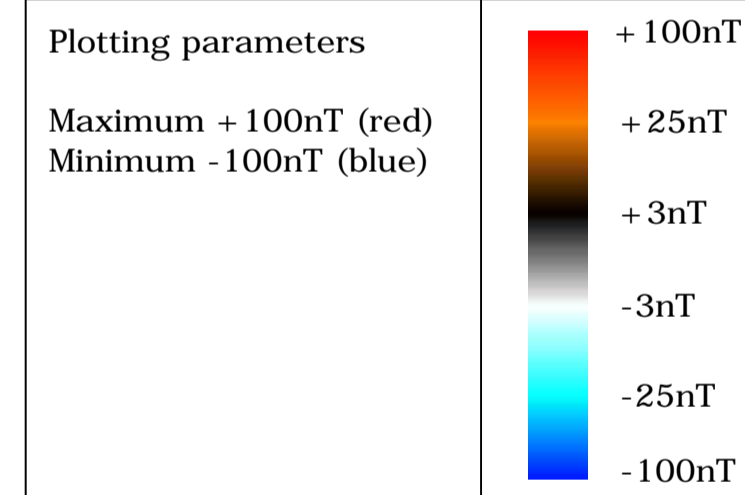
	Area unsurveyable due to high crop and overgrown vegetation
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**Amendments**

Issue No.	Date	Description
-	-	-
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-	-	-

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Job No.	8488	Survey Date	JUN 15
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Client  
**HALLAM LAND**

Project Title  
**GEOPHYSICAL SURVEY -  
VEARSE FARM, BRIDPORT,  
DORSET**

Subject  
**COLOUR PLOT OF  
GRADIOMETER DATA  
SHOWING EXTREME VALUES**

**STRATASCAN™**  
GEOPHYSICS FOR ARCHAEOLOGY  
AND ENGINEERING  
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WR8 0SA www.stratascan.co.uk



Scale 0m 10 20 30 40 50 60 70 80m  
**1:1250**

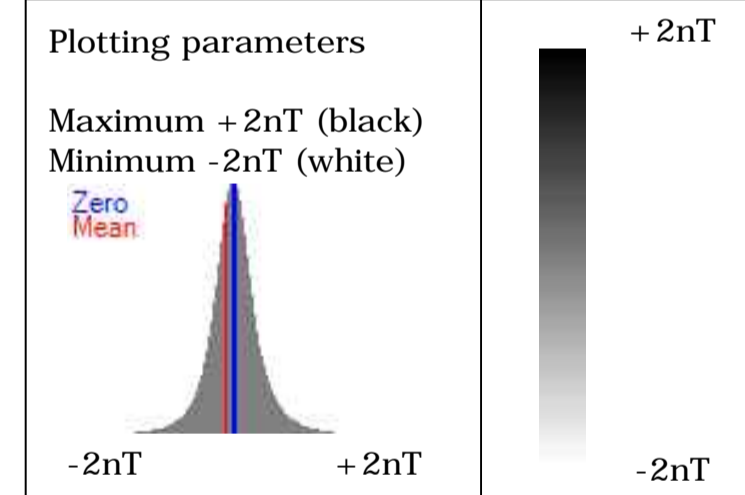
Plot	A1	Checked by	PPB	Issue No.	01
Date	JUN 15	Drawn by	RD	Figure No.	02



**Amendments**

Issue No.	Date	Description
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Job No.	8488	Survey Date	JUN 15
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Client  
**HALLAM LAND**

Project Title  
**GEOPHYSICAL SURVEY -  
VEARSE FARM, BRIDPORT,  
DORSET**

Subject  
**PLOT OF MINIMALLY  
PROCESSED GRADIOMETER  
DATA**

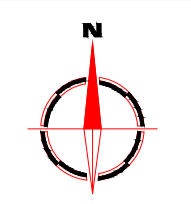
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AND ENGINEERING




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UPTON UPON SEVERN E: info@stratascan.co.uk  
WR8 0SA www.stratascan.co.uk



Scale 0m 10 20 30 40 50 60 70 80m  
**1:1250**

Plot	A1	Checked by	PPB	Issue No.	01
Date	JUN 15	Drawn by	RD	Figure No.	03



Amendments		
Issue No.	Date	Description
-	-	-
-	-	-
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<p><b>PROBABLE ARCHAEOLOGY</b></p> <ul style="list-style-type: none"> <li><span style="color: red;">—</span> Positive anomaly / weak positive anomaly - probable cut feature of archaeological origin</li> <li><span style="color: blue;">—</span> Negative anomaly / weak negative anomaly - probable bank or earthwork of archaeological origin</li> </ul> <p><b>POSSIBLE ARCHAEOLOGY</b></p> <ul style="list-style-type: none"> <li><span style="color: orange;">—</span> Positive anomaly / weak positive anomaly - possible cut feature of archaeological origin</li> <li><span style="color: purple;">—</span> Negative anomaly / weak negative anomaly - possible bank or earthwork of archaeological origin</li> </ul> <p><b>MEDIEVAL/POST-MEDIEVAL AGRICULTURE</b></p> <ul style="list-style-type: none"> <li><span style="color: green;">—</span> Widely spaced curving parallel linear anomalies - probably related to ridge-and-furrow</li> <li><span style="color: grey;">—</span> Closely spaced parallel linear anomalies - probably related to agricultural activity such as ploughing</li> <li><span style="color: purple;">—</span> Linear anomaly - probably related to a former field boundary not present on available mapping</li> <li><span style="color: orange;">—</span> Linear anomaly - related to a former field boundary present on available mapping</li> <li><span style="color: red;">—</span> Linear anomaly - related to medieval/post-medieval field system</li> <li><span style="color: grey;">—</span> Scattered magnetic debris related to former field boundary present on available mapping</li> </ul> <p><b>OTHER ANOMALIES</b></p> <ul style="list-style-type: none"> <li><span style="color: purple;">—</span> Linear anomaly - probably related to pipe, cable or other modern service</li> <li><span style="color: grey;">—</span> Linear anomaly - possibly related to land drain</li> <li><span style="color: grey;">—</span> Magnetic disturbance associated with nearby metal object such as service or field boundary</li> <li><span style="color: grey;">—</span> Strong magnetic debris - possible disturbed or made ground</li> <li><span style="color: grey;">—</span> Scattered magnetic debris</li> <li><span style="color: grey;">—</span> Area of amorphous magnetic variation - probable natural (e.g. geological or pedological) origin</li> <li><span style="color: grey;">—</span> Magnetic spike - probable ferrous object</li> </ul>		
Job No.	8488	Survey Date
		JUN 15
Client		
<b>HALLAM LAND</b>		
Project Title		
<b>GEOPHYSICAL SURVEY - VEARSE FARM, BRIDPORT, DORSET</b>		
Subject		
<b>ABSTRACTION AND INTERPRETATION OF GRADIOMETER ANOMALIES</b>		
<b>STRATASCAN™</b> GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING		
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Scale 0m 10 20 30 40 50 60 70 80m		
1:1250		
Plot	Checked by	Issue No.
A1	PPB	01
Date	Drawn by	Figure No.
JUN 15	JHS/RD	04

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