GEOPHYSICAL SURVEY REPORT

STRATASCAN™

SUMO Group Member

Project name:

Land at Hill Farm, Duns Tew, Oxfordshire

Client:

CgMs Consulting

Job ref:

J8408

March 2016

GEOPHYSICAL SURVEY REPORT

Project name: **Land at Hill Farm, Duns Tew, Oxfordshire** Client: **CgMs Consulting**	Job ref: **J8408**
Survey date: **5th, 11th & 12th February 2016**	Report date: **March 2016**
Field team: **Thomas Hynd** BSc (Hons), **Sophie Nicholson** BSc (Hons), **Alexis Thouki** MA	Project Manager: **Simon Haddrell** BEng (Hons) AMBCS PCIfA
Report written By: **Rebecca Davies** BSc (Hons)	Report approved by: **David Elks** MSc ACIfA
CAD illustrations by: **James Slater** BSc (Hons) **Rebecca Davies** BSc (Hons)	Site Director: **Dr John Gater** MCIfA FSA
Version number and issue date: **V1** 02/03/2016	Amendments:

STRATASCAN LTD
Vineyard House Upper Hook Road Upton upon Severn
Worcestershire WR8 0SA United Kingdom

T: 01684 592266 F: 01684 594142
info@stratascansumo.com www.stratascan.co.uk

SUMO Group Member

TABLE OF CONTENTS

LIST OF FIGURES

1 SUMMARY OF RESULTS

A detailed gradiometry survey was conducted over approximately 11ha of grassland. Several anomalies related to a likely Romano-British settlement have been identified, including a number of backfilled pits, ring ditches, and a sub-rectangular enclosure. Other linear anomalies may also be archaeological in origin. Former field boundaries and ridge and furrow across the site indicates that it has had a largely agricultural past. The remaining features are natural or modern and include 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 a solar farm development. This survey forms part of an archaeological investigation being undertaken by CgMs Consulting.

2.2 Site Details

NGR / Postcode	SP 454 301 OX15 0QB
Location	The survey area is situated to the north of Duns Tew and south-east of the village of Deddington, Oxfordshire. A tributary to the River Cherwell forms the northern boundary of the site with woodland to the south-west and agricultural land on all other sides.
	
HER/SMR	Oxfordshire
District	Cherwell

Parish	Duns Tew
Topography	The site lies on the southern side of a wide shallow valley and is situated approximately 85m above OD on the flat floodplain of the valley bottom.
Current Land Use	Pasture/sheep grazing
Weather Conditions	Overcast but dry
Soils	Wickham 2. These are typical stagnogley soils and consist of seasonally waterlogged, fine loamy over clayey soils. (SSEW 1983, Sheet 6 South East England)
Geology	Charmouth Mudstone Formation – Mudstone. Superficial deposits: None recorded (BGS, 2016)
Archaeology	Extract from "Land at Hill Farm, Duns Tew, Oxfordshire – Heritage Assessment" (CgMs Consulting, 2015): *"The assessment has established that the proposed development area has only low potential to yield prehistoric, Roman and Medieval period archaeology. The desk based work has also indicated that there is no potential for archaeology associated with the post medieval and modern periods."*
Survey Methods	Detailed magnetometer survey (gradiometer)
Study Area	c.11ha

2.3 Aims and objectives

To locate and characterise any anomalies of possible archaeological interest within the study area.

3 METHODS, PROCESSING & PRESENTATION

3.1 Standards & Guidance

This report and all fieldwork have been conducted in accordance with the latest guidance documents issued by Historic England (2008) and the Chartered Institute for Archaeologists (2002 & 2014).

Stratascan Ltd are a Registered Organisation with the CIfA and are committed to upholding its policies and standards.

3.2 Survey methods

Detailed magnetic survey was used as an efficient and effective method of locating archaeological anomalies.

More information regarding this technique is included in Appendix A.

3.3 Processing

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

1. *Destripe*
2. *Destagger*

3.4 Presentation of results and interpretation

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

When interpreting the results several factors are taken into consideration, including the nature of archaeological features being investigated and the local conditions at the site (geology, pedology, topography etc.). Anomalies are categorised by their potential origin. Where responses can be related to very specific known features documented in other sources, this is done (for example: Abbey Wall, Roman Road). For the generic categories levels of confidence are indicated, for example: probable, or possible archaeology. The former is used for a confident interpretation, based on anomaly definition and/or other corroborative data such as cropmarks. Poor anomaly definition, a lack of clear patterns to the responses and an absence of other supporting data reduces confidence, hence the classification "possible".

4 RESULTS

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

4.1 Probable Archaeology

1 A number of positive linear and curvilinear anomalies across the centre of the site. These are indicative of former cut features, such as ditches. The features are related to an area of former settlement activity of likely Romano-British origin.

2-3 A sub-rectangular enclosure in the east of the area covering approximately 0.2ha (roughly 53m x 45m). This appears to contain a number of circular anomalies (Anomaly 3) and is representative of a small enclosed settlement. Anomaly 3 comprises a number of circular and sub-circular anomalies within the sub-rectangular enclosure and are likely to be associated with former roundhouses and provide evidence of Romano-British occupation.

4-5 A number of circular and sub-circular anomalies. These are related to the former Romano-British settlement and may be related to round houses or small enclosures.

6-9 A number of small discrete positive anomalies in several locations. These are indicative of former backfilled pits and are further evidence of settlement activity. Anomalies 6 and 8 are associated with ring ditches, Anomalies 7 are associated with the enclosed settlement and Anomalies 9 are representative of further activity within a wider area.

10 Areas of enhanced magnetic response associated with Anomalies 1 and 2. These are indicative of former cut features and are related to the Romano-British settlement

4.2 Possible Archaeology

11-12 A weak positive curvilinear anomaly in the south of the site. This is indicative of a former cut feature, such as a ditch, and may be of archaeological origin. This feature may be related to the settlement activity to the north, however the weak and truncated nature of the anomaly makes further interpretation difficult. Anomaly 12, a negative linear anomaly indicative of a former bank, appears to be associated with the ditch of Anomaly 11.

4.3 Medieval/Post-Medieval Agriculture

13 Areas of widely spaced, slightly curved, parallel linear anomalies. These are indicative of ridge and furrow cultivation.

14-15 Linear anomalies in the north of the area. These are associated with former field boundaries, both of which are present on available OS mapping from 1880 to 1954. Anomaly 15a is an area of scattered magnetic debris which is also likely to be related to the field boundaries.

16-18 A number of linear anomalies in the north-west corner and south of the site. These are likely to be related to former field boundaries that are not visible on available OS mapping.

4.4 Other Anomalies

19 Areas of amorphous magnetic variation, mostly along the northern edge of the site. These are likely to be natural in origin, with the large area in the north likely associated with alluvial deposits from the adjacent brook.

20 An area of scattered magnetic debris in the south of the area. This is likely to be modern in origin or related to the field boundary running through it.

21 Areas of magnetic disturbance are the result of substantial nearby ferrous metal objects such as fences and a foot bridge. These effects can mask weaker archaeological anomalies, but on this site have not affected a significant proportion of the area.

22 A number of magnetic 'spikes' indicate ferrous metal objects. These are likely to be modern rubbish.

5 DATA APPRAISAL & CONFIDENCE ASSESSMENT

Charmouth Mudstone geologies usually provide a good response for gradiometer survey. The data across the majority of the site shows a high contrast between anomalies and the background magnetic response, and identifies a wide range of archaeological features. The data across the northern part of the site is dominated by natural deposits, likely related to alluvial deposits of the adjacent brook. These deposits have the potential to mask weaker archaeological anomalies. Despite the potential for these deposits to mask weaker features, it is unlikely that any significant remains would have been discovered in this location, and that the main focus of settlement activity has been detected. Evidence of later ridge and furrow does not appear to have affected the buried archaeology, suggesting that the archaeology is at a greater depth than that reached by ploughing.

6 CONCLUSION

The survey at Duns Tew has identified a number of previously unrecorded archaeological anomalies. The features include a number of ring ditches, a sub-rectangular enclosure and numerous backfilled pits. The sub-rectangular enclosure containing a number of ring ditches appears to form a small enclosed settlement. The further range of ring ditches and linear anomalies are indicative of a wider area of settlement activity of likely Romano-British origin. Further linear anomalies may be related to a banked ditch, though the origin of this feature cannot be determined with confidence. Evidence of ridge and furrow cultivation and former field boundaries suggest that the site has been used for agricultural purposes since the medieval period. The remaining features are natural or modern and include an area of scattered magnetic debris, magnetic disturbance from nearby ferrous objects, and magnetic spikes which are likely to be modern rubbish.

7 REFERENCES

British Geological Survey, n.d., *website*: (http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps) *Geology of Britain viewer. [Accessed 11/01/2015]*

CgMs Consulting, 2015. *Land at Hill Farm, Duns Tew, Oxfordshire – Heritage Statement*

Chartered Institute For Archaeologists. *Standard and Guidance for Archaeological Geophysical Survey. (*http://www.archaeologists.net/sites/default/files/CIfAS&GGeophysics_1.pdf)

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

IfA 2002. *The Use of Geophysical Techniques in Archaeological Evaluations, IFA Paper No 6, C. Gaffney, J. Gater and S. Ovenden. Institute for Archaeology, Reading*

Soil Survey of England and Wales, 1983. *Soils of England and Wales, Sheet 3 Midland and Western England*

Appendix A - Technical Information: Magnetometer Survey Method

Grid Positioning

For hand held gradiometers the location of the survey grids has been plotted together with the referencing information. Grids were set out using a Trimble R8 Real Time Kinematic (RTK) VRS Now GNSS GPS system.

For CARTEASY^{N} collected data each data point had its position recorded using a Trimble R10 Real Time Kinematic (RTK) VRS Now GNSS GPS system. The geophysical survey area is georeferenced relative to the Ordnance Survey National Grid.

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. This results in an accuracy of around 0.01m.

Technique	Instrument	Traverse Interval	Sample Interval
Magnetometer	Bartington Grad 601-2	1m	0.25m
Magnetometer	CartEasy^{N} cart system (Bartington Grad 601 sensors)	0.75m	0.125m

Instrumentation: Bartington *Grad*601-2 / GSB CARTEASY^{N} Cart system

Both the Bartington and CARTEASY^{N} instruments operate in a gradiometer configuration which comprises fluxgate sensors mounted vertically, set 1.0m apart. The fluxgate gradiometer suppresses any diurnal or regional effects. The instruments are carried, or cart mounted, with the bottom sensor approximately 0.1-0.3m from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is measured in nanoTesla (nT). The sensitivity of the instrument can be adjusted; for most archaeological surveys the most sensitive range (0.1nT) is used. Generally, features up to 1m deep may be detected by this method, though strongly magnetic objects may be visible at greater depths. The Bartington instrument can collect two lines of data per traverse with gradiometer units mounted laterally with a separation of 1.0m. The CARTEASY^{N} system has four gradiometer units mounted at 0.75m intervals across its frame – rather than working in grids, the cart uses an on-board survey grade GNSS for positioning. The cart system allows for the collection of topographic data in addition to the magnetic field measurements.

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.

Data Processing

Zero Mean Traverse	This process sets the background mean of each traverse within each grid to zero. The operation removes striping effects and edge discontinuities over the whole of the data set.
Step Correction (Destagger)	When gradiometer data are collected in 'zig-zag' fashion, stepping errors can sometimes arise. These occur because of a slight difference in the speed of walking on the forward and reverse traverses. The result is a staggered effect in

	the data, which is particularly noticeable on linear anomalies. This process corrects these errors.
Interpolation	When geophysical data are presented as a greyscale, each data point is represented as a small square. The resulting plot can sometimes have a 'blocky' appearance. The interpolation process calculates and inserts additional values between existing data points. The process can be carried out with points along a traverse (the x axis) and/or between traverses (the y axis) and results in a smoother greyscale image.

Display

Greyscale/ Colourscale Plot	This format divides a given range of readings into a set number of classes. Each class is represented by a specific shade of grey, the intensity increasing with value. All values above the given range are allocated the same shade (maximum intensity); similarly all values below the given range are represented by the minimum intensity shade. Similar plots can be produced in colour, either using a wide range of colours or by selecting two or three colours to represent positive and negative values. The assigned range (plotting levels) can be adjusted to emphasise different anomalies in the data-set.

Interpretation Categories

In certain circumstances (usually when there is corroborative evidence from desk based or excavation data) very specific interpretations can be assigned to magnetic anomalies (for example, *Roman Road, Wall,* etc.) and where appropriate, such interpretations will be applied. The list below outlines the generic categories commonly used in the interpretation of the results.

Archaeology/ Probable Archaeology	This term is used when the form, nature and pattern of the response are clearly or very probably archaeological and /or if corroborative evidence is available. These anomalies, whilst considered anthropogenic, could be of any age.
Possible Archaeology	These anomalies exhibit either weak signal strength and / or poor definition, or form incomplete archaeological patterns, thereby reducing the level of confidence in the interpretation. Although the archaeological interpretation is favoured, they may be the result of variable soil depth, plough damage or even aliasing as a result of data collection orientation.
Industrial / Burnt-Fired	Strong magnetic anomalies that, due to their shape and form or the context in which they are found, suggest the presence of kilns, ovens, corn dryers, metal-working areas or hearths. It should be noted that in many instances modern ferrous material can produce similar magnetic anomalies.
Former Field Boundary (probable & possible)	Anomalies that correspond to former boundaries indicated on historic mapping, or which are clearly a continuation of existing land divisions. Possible denotes less confidence where the anomaly may not be shown on historic mapping but nevertheless the anomaly displays all the characteristics of a field boundary.
Ridge & Furrow	Parallel linear anomalies whose broad spacing suggests ridge and furrow cultivation. In some cases the response may be the result of more recent agricultural activity.
Agriculture (ploughing)	Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes.

Land Drain	Weakly magnetic linear anomalies, quite often appearing in series forming parallel and herringbone patterns. Smaller drains will often lead and empty into larger diameter pipes and which in turn usually lead to local streams and ponds. These are indicative of clay fired land drains.
Natural	These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions.
Magnetic Disturbance	Broad zones of strong dipolar anomalies, commonly found in places where modern ferrous or fired materials (e.g. brick rubble) are present. They are presumed to be modern.
Service	Magnetically strong anomalies usually forming linear features indicative of ferrous pipes/cables. Sometimes other materials (e.g. pvc) cause weaker magnetic responses and can be identified from their uniform linearity crossing large expanses.
Ferrous	This type of response is associated with ferrous material and may result from small items in the topsoil, larger buried objects such as pipes, or above ground features such as fence lines or pylons. Ferrous responses are usually regarded as modern. Individual burnt stones, fired bricks or igneous rocks can produce responses similar to ferrous material.
Uncertain Origin	Anomalies which stand out from the background magnetic variation, yet whose form and lack of patterning gives little clue as to their origin. Often the characteristics and distribution of the responses straddle the categories of *Possible Archaeology* and *Possible Natural* or (in the case of linear responses) *Possible Archaeology* and *Possible Agriculture*; occasionally they are simply of an unusual form.

Where appropriate some anomalies will be further classified according to their form (positive or negative) and relative strength and coherence (trend: weak and poorly defined).

Appendix B - Technical Information: Magnetic Theory

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. 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.

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.

Survey services you can rely on

sumo Survey Services

Your Survey Partner

For a complete and complementary range of survey services.

Survey services you can rely on

- Archaeological
- As Built Records
- Boundary Disputes
- CCTV
- Geophysical
- Laser Scanning
- Measured Building
- Pipeline Routes
- Railway
- Retrofit
- Setting Out
- Statutory Plan Collation
- Topographic
- Utility Mapping
- UXO Detection
- Void Detection