GEOPHYSICAL SURVEY REPORT

Bosworth Lane, Newbold Verdon

Client

Orion Heritage Ltd

For

Bloor Homes (East Midlands)

Survey Report

20178

OASIS Ref. No.

Sumogeop1-529524

Date

25 November 2024

Survey Report 20178: Bosworth Lane, Newbold Verdon

Survey dates	18 November 2024
Field co-ordinator	Simon Lobel BSc
Field Team	Darcy Hooper MSc
Report Date	25 November 2024
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3 SURVEY TECHNIQUE

3.1 Detailed magnetic survey (magnetometry) was chosen as the most efficient and effective method of locating the type of archaeological anomalies which might be expected at this site. All survey techniques followed the guidance set out by CIfA (2020) and the European Archaeology Council (EAC) (2016).

Bartington Cart System Traverse Interval 1.0m Sample Interval 0.125m

The only processes performed on data are the following unless specifically stated otherwise:

Zero Mean Traverse	This process sets the background mean of each traverse within each grid to zero. The operation removes instrument striping effects and edge discontinuities over the whole of the data set.

4 EXECUTIVE SUMMARY OF RESULTS

4.1 A magnetometer survey of 8.5 hectares of land off Bosworth Lane, Newbold Verdon has not recorded any magnetic responses that could be interpreted as being of archaeological interest. Uncertain trends are visible in the survey data which are likely to have been caused by natural and agricultural processes. The route of a former field boundary has also been marked.

5 INTRODUCTION

5.1 **SUMO GeoSurveys** was commissioned to undertake a geophysical survey of an area outlined for residential development. This survey forms part of an archaeological investigation being undertaken by **Orion Heritage Ltd** on behalf of **Bloor Homes (East Midlands).**

5.2 Site Details

NGR / Postcode	SK 44118 04151 / CV13 0DS	
Location	The site is located 3.5km north-west of Desford, on the north-western outskirts of Newbold Verdon, some 14km west of Leicester. The survey area is bounded to the north-west by Bosworth Lane and to the north-east by houses off Old Farm Lane.	
HER	Leicestershire HER	
OASIS Ref. No.	Sumogeop1-529524	
District	Hinckley and Bosworth District	
Parish	Newbold Verdon Civil Parish	
Topography	Flat	
Land Use	Arable	
Geology (BGS 2024)	Bedrock:	Gunthorpe Member - Mudstone
	Superficial:	Glaciofluvial Deposits, Mid Pleistocene - Sand and gravel
		Oadby Member - Diamicton
Soils (CU 2024)	Soilscape 18: Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils Soilscape 22: Loamy soils with naturally high groundwater	
Survey Methods	Magnetometer survey (fluxgate gradiometer)	
Study Area	8.5 ha	

5.3 ***Archaeological Background*** *(HG 2024)*

5.3.1 A search of the Leicestershire HER has revealed that no designated or non-designated heritage assets are recorded within the survey area. 100m north of the site in 1979, four sherds of Roman pottery were recovered during fieldwalking (three greyware and a red grit mortarium); they could indicate occupation in the vicinity (MLE2978). The survey area is located 100m north of the historic core of the village which has Late Anglo-Saxon origins and was noted in the Domesday Book (MLE2992). South of the site are the remains of Newbold Verdon Hall formal gardens (MLE2988) which were created by James Montague between 1722 and 1744. They consisted of avenues, a parterre (the moated site), various ponds, a wilderness garden, a sunken garden and a possible area of ornamental plantations.

5.4 ***Aims and Objectives***

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

6 RESULTS

6.1 *Probable / Possible Archaeology*

6.1.1 No magnetic responses have been recorded that could be interpreted as being of archaeological interest.

6.2 *Uncertain*

6.2.1 Numerous trends have been recorded in the survey which have been assigned to the category of *Uncertain*. They generally lack the defined morphology of anomalies that would ordinarily warrant an archaeological interpretation. They have probably been caused by underling geological variations or agricultural processes.

6.3 *Former Field Boundary – Corroborated*

6.3.1 A linear anomaly has been detected in the survey which corresponds with the route of a former field boundary that is visible on multiple editions of historic mapping (see Figure 05).

6.4 *Ferrous / Magnetic Disturbance*

6.4.1 Ferrous responses close to boundaries are due to adjacent fences and gates. Smaller scale ferrous anomalies ("iron spikes") are present throughout the data and are characteristic of small pieces of ferrous debris (or brick / tile) in the topsoil; they are commonly assigned a modern origin. Only the most prominent of these are highlighted on the interpretation diagram.

7 DATA APPRAISAL & CONFIDENCE ASSESSMENT

7.1 Historic England Table 4 (EH 2008) states that the typical magnetic response on the local soils / geology is variable. The results from this survey indicate the presence of a former field boundary; consequently, there is no *a priori* reason why archaeological features would not have been detected.

8 CONCLUSION

8.1 The magnetometer survey has not recorded any magnetic responses that could be interpreted as being of definite archaeological interest. Trends of uncertain origin have been plotted across the survey area which are likely to have been caused by variation in the underlying geology or agricultural processes. The route of a former field boundary has also been marked.

9 REFERENCES

BGS 2024 *Geology of Britain Viewer,* British Geological Survey*,* website: (http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps)

CIfA 2020 *Standard and Guidance for Archaeological Geophysical Survey.* 2014 amended 2020. CIfA Guidance note. Chartered Institute for Archaeologists, Reading https://www.archaeologists.net/sites/default/files/CIfAS%26GGeophysics_3.pdf

CU 2024 *The Soils Guide*. www.landis.org.uk. Cranfield University, UK. website: http://mapapps2.bgs.ac.uk/ukso/home.html

EAC 2016 *EAC Guidelines for the Use of Geophysics in Archaeology,* European Archaeological Council, Guidelines 2.

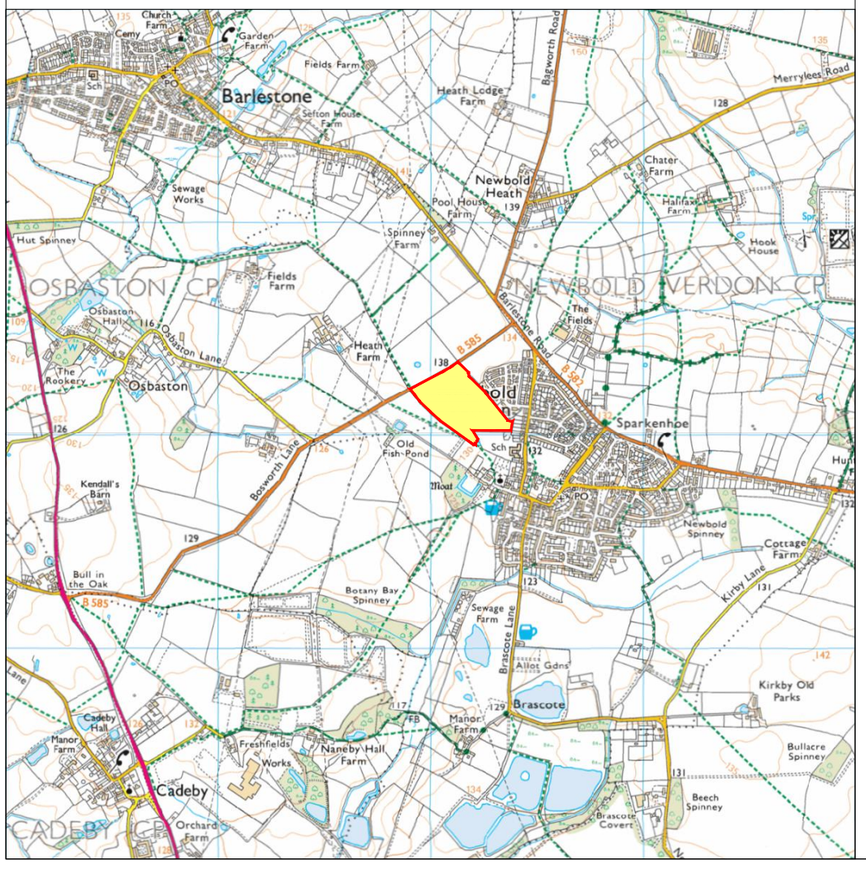
EH 2008 *Geophysical Survey in Archaeological Field Evaluation.* English Heritage, Swindon (now withdrawn, but used for evaluating suitability of soil types)

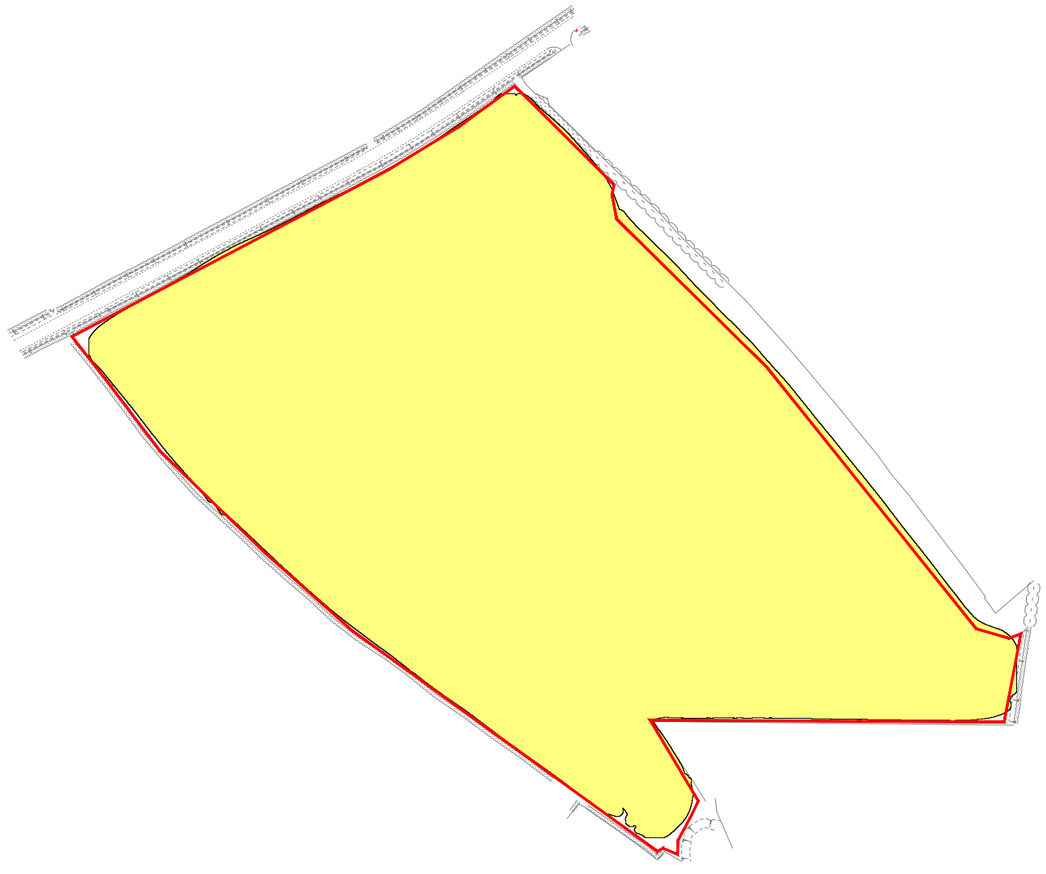
HG 2024 *Heritage Gateway Online Viewer,* website: *https://www.heritagegateway.org.uk/gateway/*

10 ARCHIVE

10.1 The minimally processed data, data images, XY traces and a copy of this report are stored in **SUMO GeoSurveys'** digital archive, on an internal RAID configured NAS drive in the Midlands Office. These data are also backed up to the Cloud for off-site storage*.*

10.2 The Grey Literature will be archived with OASIS and the relevant HER within a period of 12 months.





N

Survey Areas

sumo GeoSurveys

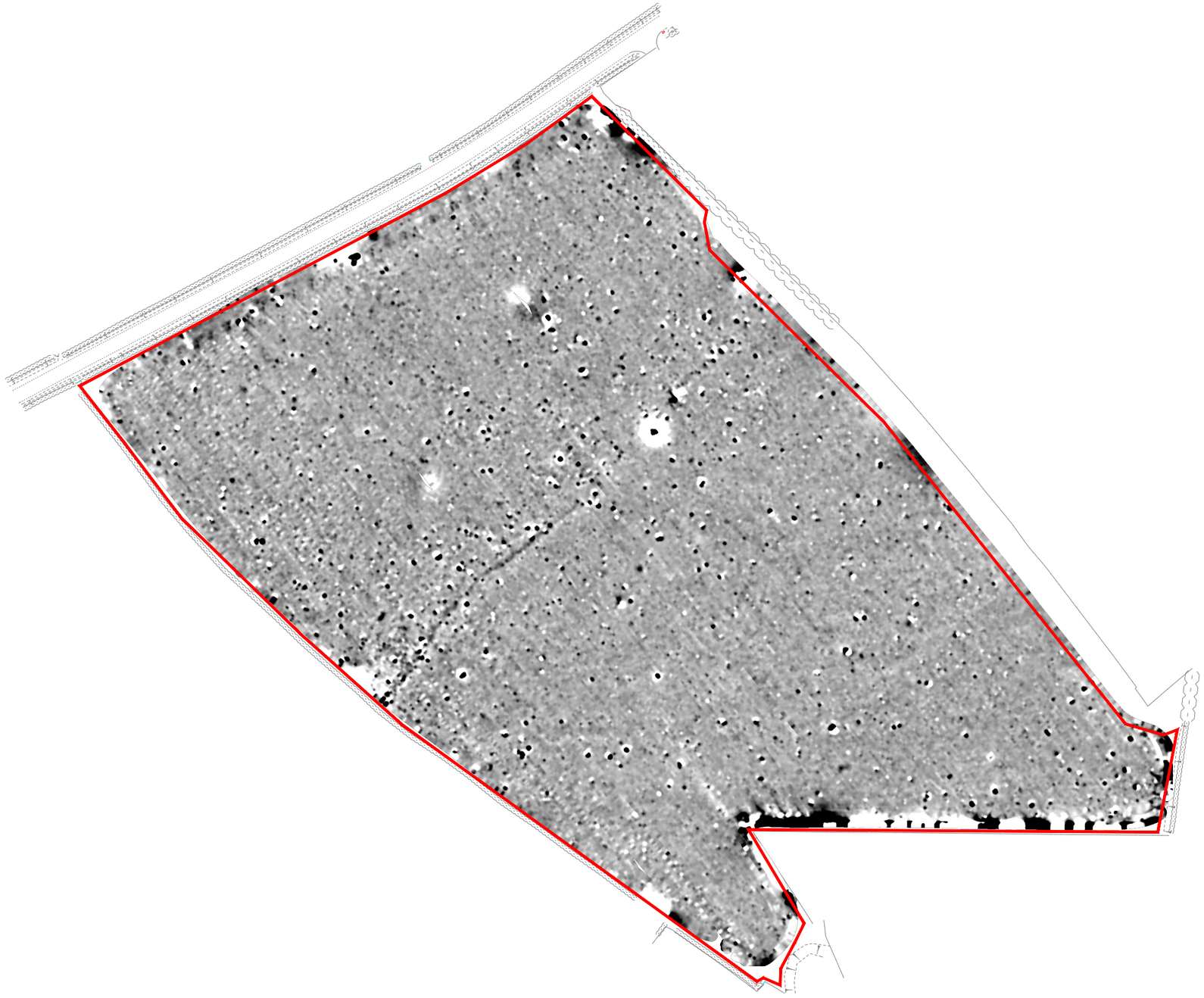
Title:
Site Location

Client:
Orion Heritage Ltd

Project:
20178 - Bosworth Lane, Newbold Verdon

Scale:
NOT TO SCALE

Fig No:
01



N

+2nT

-1nT

sumo GeoSurveys

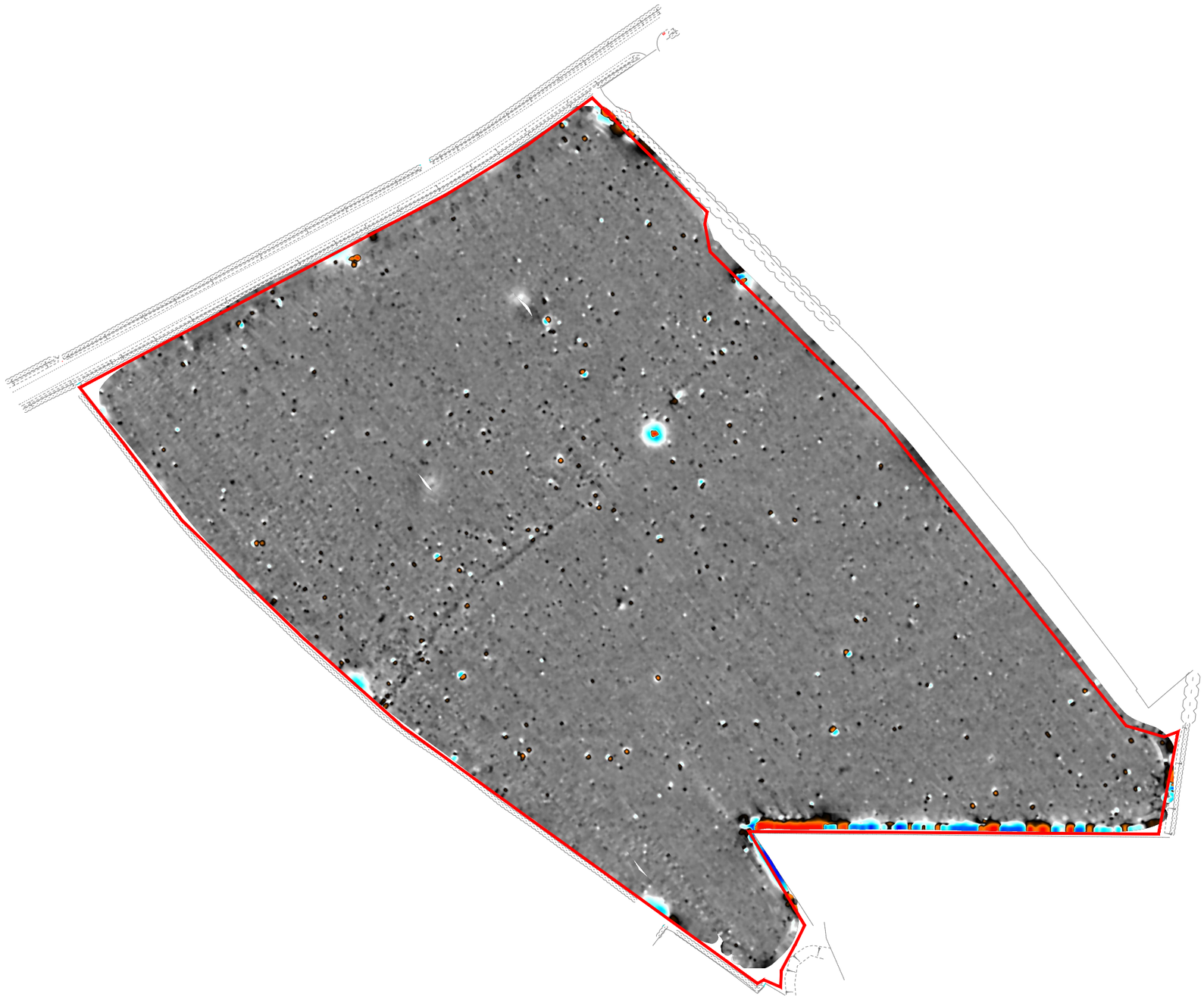
Title:
Magnetometer Survey - Greyscale Plot

Client:
Orion Heritage Ltd

Project:
20178 - Bosworth Lane, Newbold Verdon

Scale:
0 metres 100
1:2000 @ A3

Fig No:
02



N

+100nT

-100nT

sumo GeoSurveys

Title:

Magnetometer Survey - Colour Plot

Client:

Orion Heritage Ltd

Project:

20178 - Bosworth Lane, Newbold Verdon

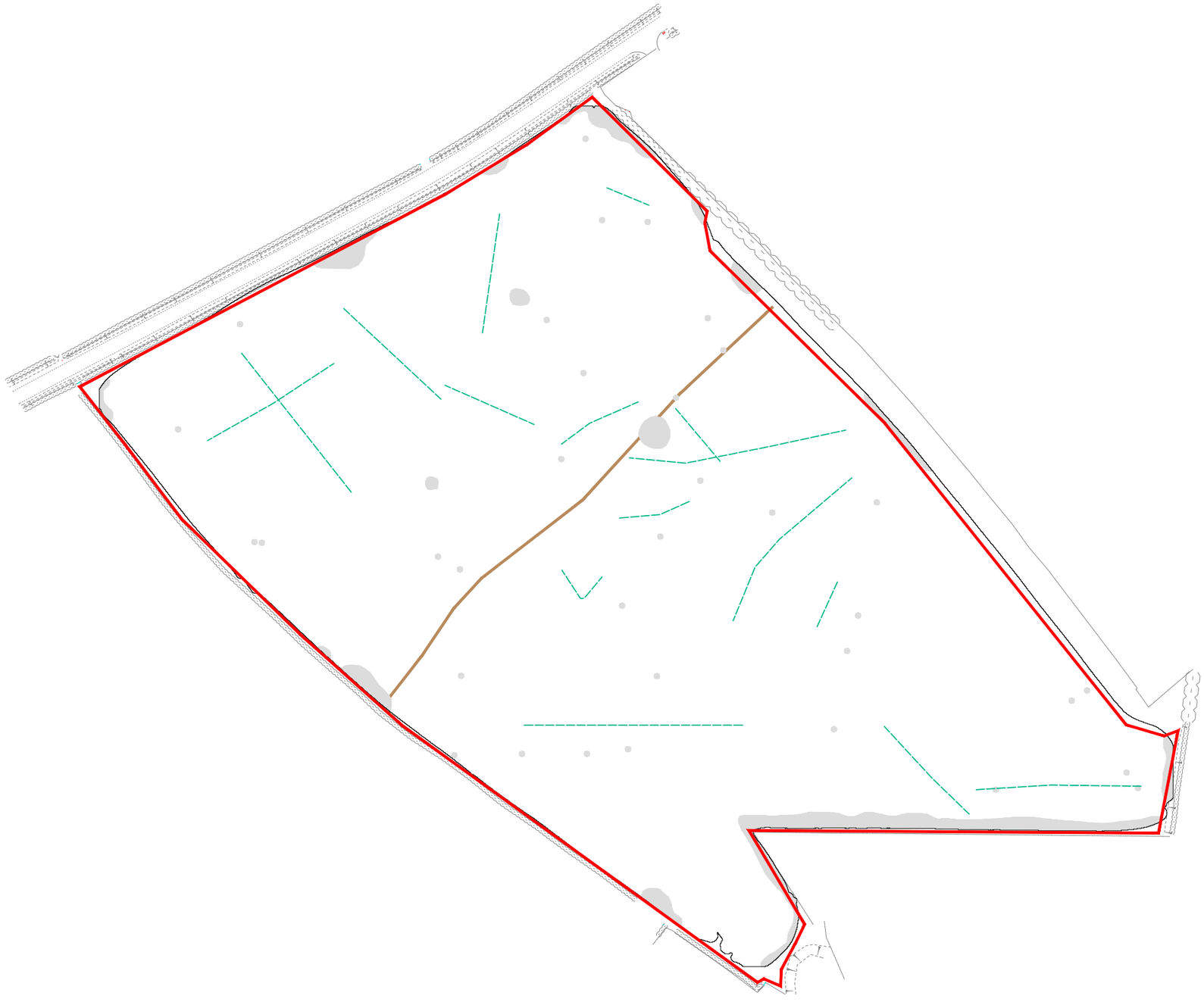
Scale:

0 metres 100

1:2000 @ A3

Fig No:

03



N

KEY

	Uncertain Origin (discrete anomaly / trend / increased response)
	Former field boundary (corroborated)
	Ferrous

sumo GeoSurveys

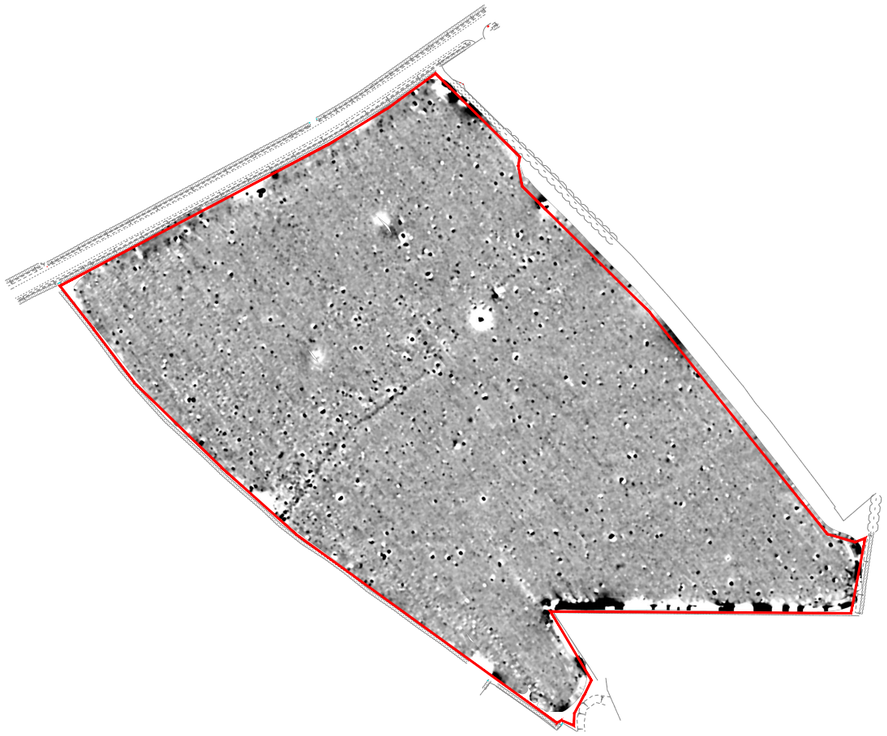
Title:
Magnetometer Survey - Interpretation

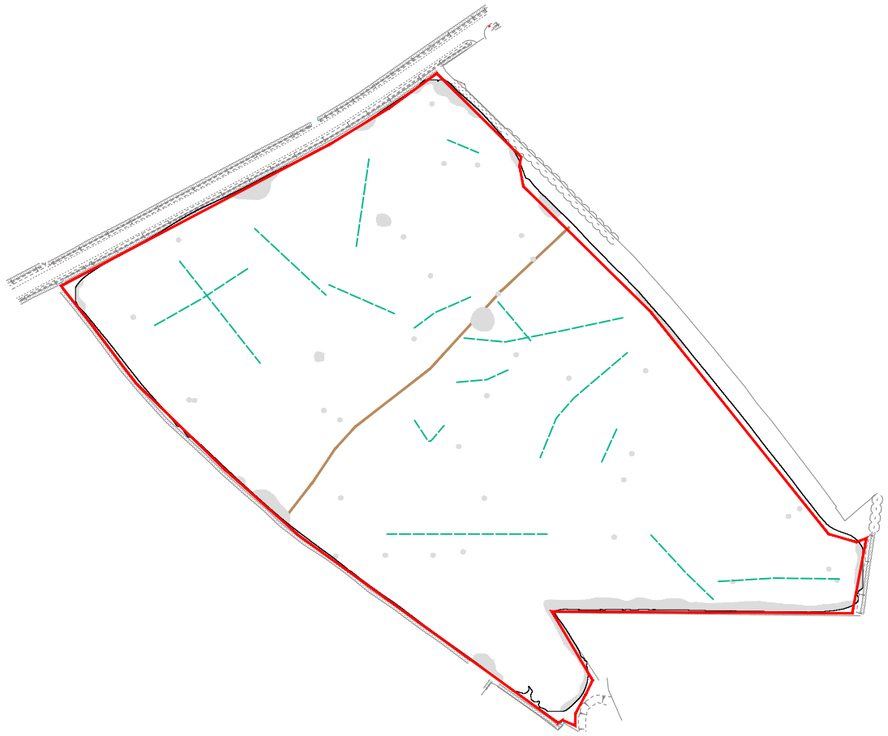
Client:
Orion Heritage Ltd

Project:
20178 - Bosworth Lane, Newbold Verdon

Scale:
0 metres 100
1:2000 @ A3

Fig No:
04





N

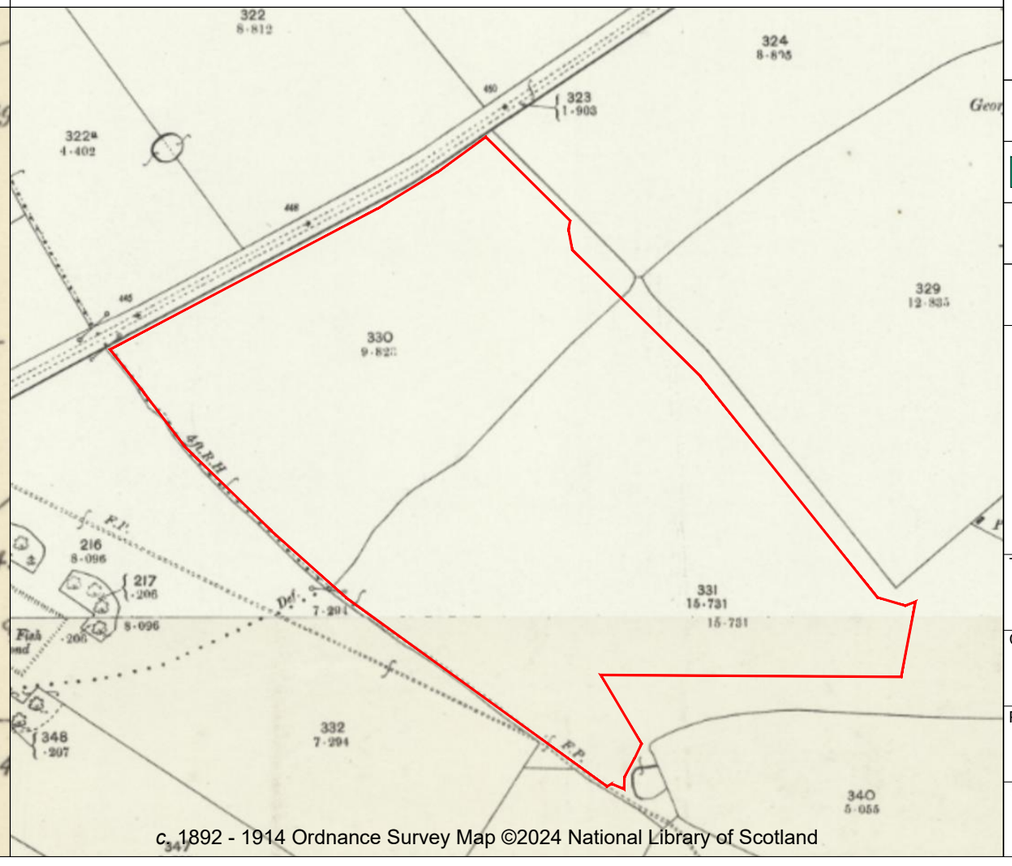
+2nT

-1nT

KEY

	Uncertain Origin (discrete anomaly / trend / increased response)
	Former field boundary (corroborated)
	Ferrous

c. 1830 - 1880 Ordnance Survey Map ©2024 National Library of Scotland



c. 1892 - 1914 Ordnance Survey Map ©2024 National Library of Scotland

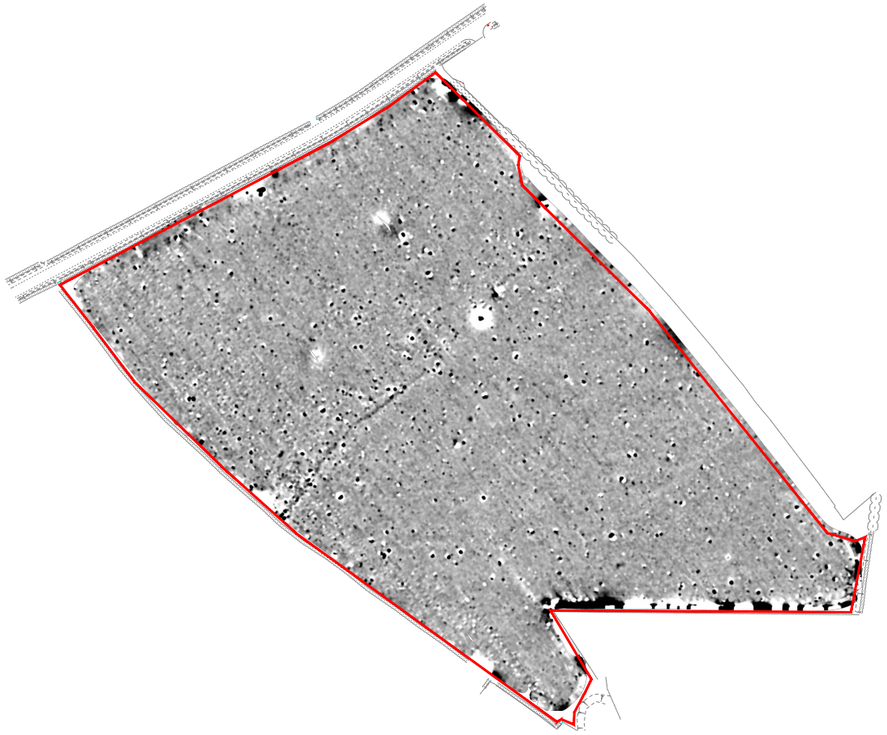
Title: Greyscale Plot / Interpretation / 1830-1888 (bottom left) & 1892-1914 (bottom right) Ordnance Survey Mapping

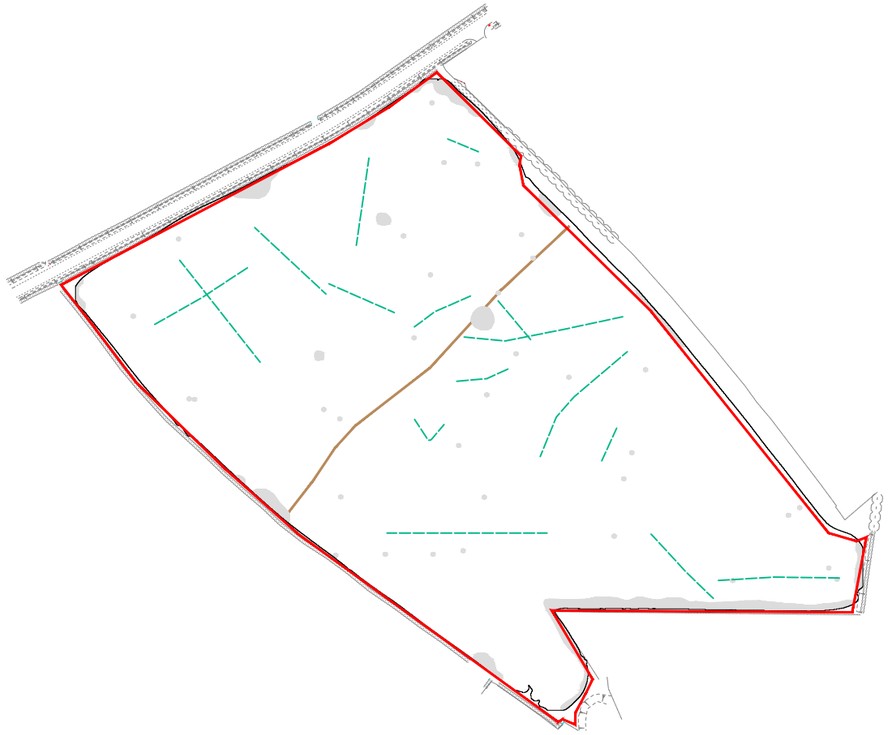
Client: Orion Heritage Ltd

Project: 20178 - Bosworth Lane, Newbold Verdon

Scale: NOT TO SCALE

Fig No: 05





N

+2nT

-1nT

KEY

	Uncertain Origin (discrete anomaly / trend / increased response)
	Former field boundary (corroborated)
	Ferrous

sumo GeoSurveys

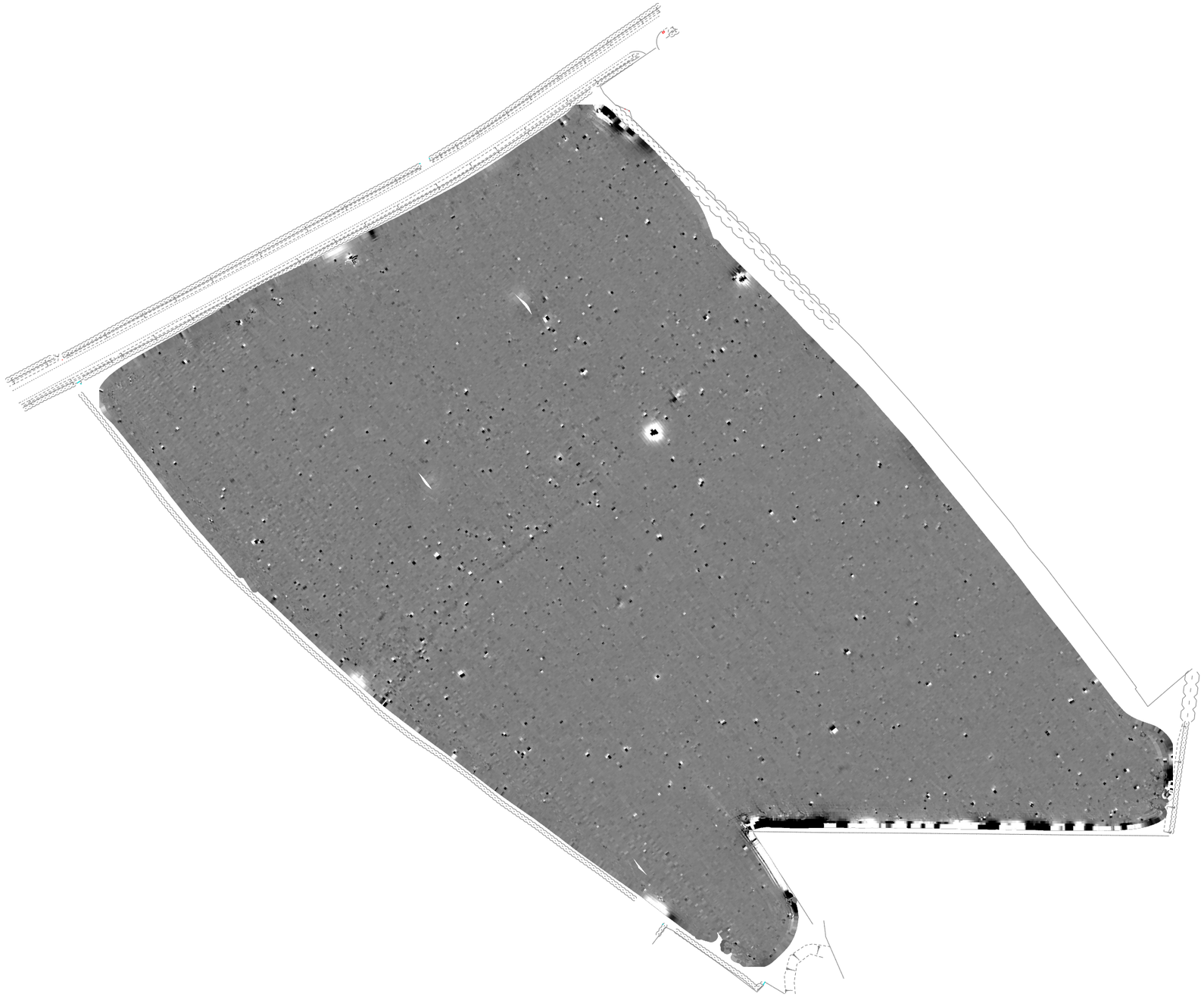
Title: Greyscale Plot / Interpretation / 1985 (bottom left) & 2023 (bottom right) Aerial Imagery

Client: Orion Heritage Ltd

Project: 20178 - Bosworth Lane, Newbold Verdon

Scale: NOT TO SCALE

Fig No: 06



N

+10nT

-10nT

sumo GeoSurveys

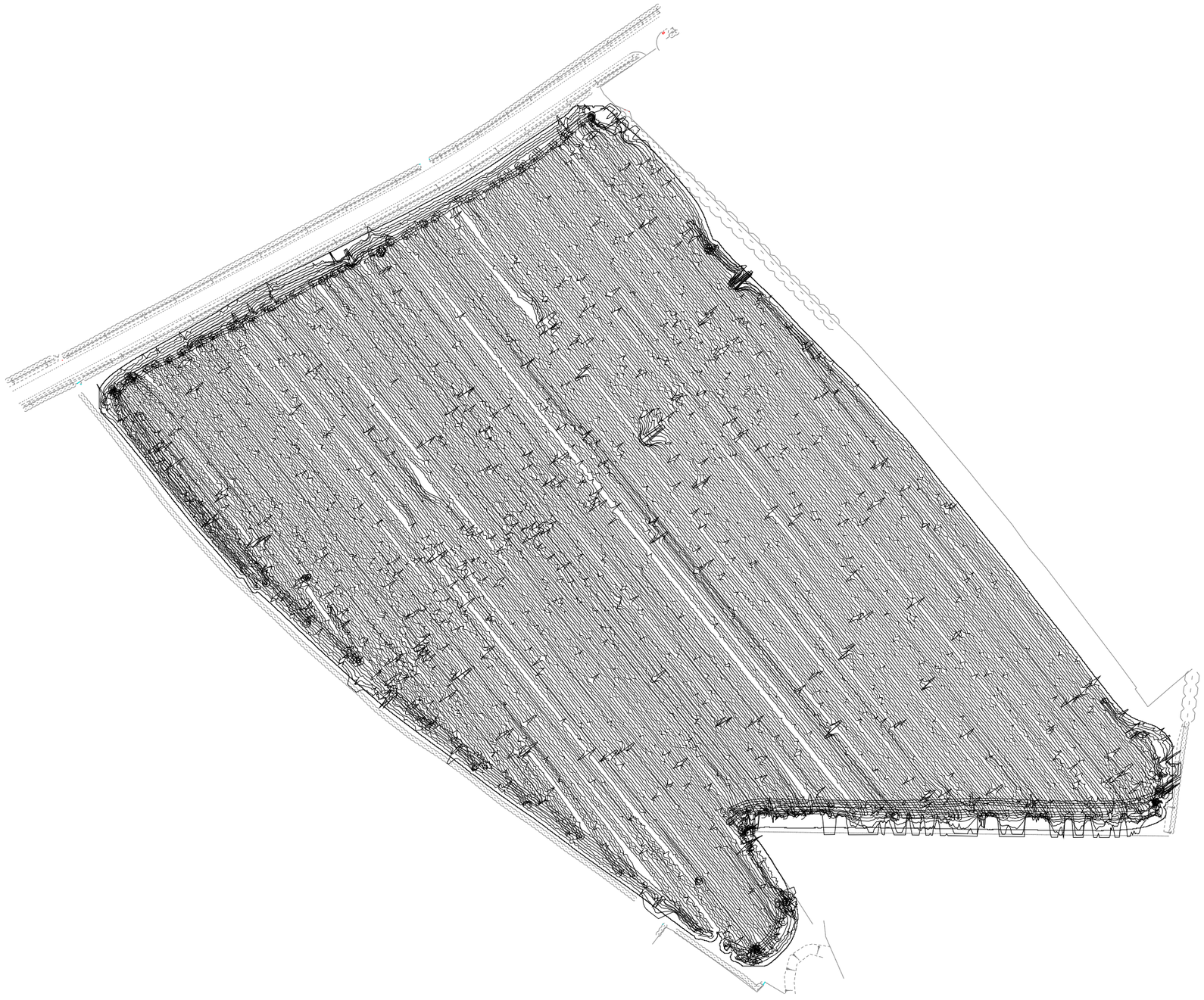
Title:
Minimally Processed Data - Greyscale Plot

Client:
Orion Heritage Ltd

Project:
20178 - Bosworth Lane, Newbold Verdon

Scale:
0 metres 100
1:2000 @ A3

Fig No:
07



N

sumo GeoSurveys

Title:
XY Trace Plots (clipped at +/-15nT)

Client:
Orion Heritage Ltd

Project:
20178 - Bosworth Lane, Newbold Verdon

Scale:
0 metres 100
1:2000 @ A3

Fig No:
08

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.

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	1.0m	0.25m
Magnetometer	Bartington Cart System	1.0m	0.125m

Instrumentation:

Bartington instruments operate in a gradiometer configuration which comprises fluxgate sensors mounted horizontally, 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.

Bartington Grad 601-2

Hand-Held: Data will be collected using a Bartington Grad 601-2. The instrument consists of two paired sensors and readings are logged at 0.25m centres along traverses 1.0m apart across 30m grids. The collection of data at 0.25m centres provides an appropriate methodology balancing cost and time with resolution as per Historic England guidelines

Bartington Cart System

Data will be collected using a cart carrying four paired Bartington magnetic sensors. Each data point is geographically referenced using an on-board Trimble RTK survey grade GPS system. Readings will be taken at 0.125m centres along traverses 1.0m apart.

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 (De-stagger)	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.

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 responses 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 may lead and empty into larger diameter pipes, 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.
Service	Magnetically strong anomalies, usually forming linear features are indicative of ferrous pipes/cables. Sometimes other materials (e.g. pvc) or the fill of the trench can cause weaker magnetic responses which can be identified from their uniform linearity.
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* / *Natural* or (in the case of linear responses) *Possible Archaeology* / *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 0.1 nanoTeslas (nT) in an overall field strength of 48,000 (nT), 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; 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 feature. The difference between the two sensors will relate to the strength of a magnetic field created by this 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 and disturbance from modern services.

Appendix C - OASIS Summary

OASIS ID (UID)	sumogeop1-529524
Project Name	Magnetometry Survey, Geophysical Survey at Bosworth Lane, Newbold Verdon
Sitename	Bosworth Lane, Newbold Verdon
Sitecode	20178
Project Identifier(s)	20178
Activity type	Magnetometry Survey, Geophysical Survey, MAGNETOMETRY SURVEY
Planning Id	
Reason For Investigation	Planning requirement
Organisation Responsible for work	SUMO Geophysics Ltd.
Project Dates	18-Nov-2024 - 18-Nov-2024
Location	**Bosworth Lane, Newbold Verdon** NGR: SK 44155 04136 LL: 52.633187434707196, -1.349022532885765 12 Fig: 444155,304136
Administrative Areas	Country: England County/Local Authority: Leicestershire Local Authority District: Hinckley and Bosworth Parish: Osbaston Parish: Newbold Verdon
Project Methodology	A temporary grid system was established over the site and marked out using canes. The location of the grid was set out using an RTK GPS system theoretically accurate to some 0.01m and referenced to OS co-ordinates. Data was collected using a cart carrying four paired Bartington magnetic sensors. Four sensors mounted 1m horizontally apart and 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. Each data point is geographically referenced using an on-board Trimble RTK survey grade GPS system. Readings were taken at 0.125m centres along traverses 1.0m apart. Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background.
Project Results	The magnetometer survey has not recorded any magnetic responses that could be interpreted as being of definite archaeological interest. Trends of uncertain origin have been plotted across the survey area which are likely to have been caused by variation in the underlying geology or agricultural processes. The route of a former field boundary has also been marked.
Keywords	Field Boundary - POST MEDIEVAL - FISH Thesaurus of Monument Types
Funder	Private or public corporation Orion Heritage Ltd
HER	Leicestershire HER - unRev - STANDARD
Person Responsible for work	Thomas Cockcroft
HER Identifiers	
Archives	

Report generated on: 25-11-2024:1610

Appendix D – Data Management Plan & Archive Selection Strategy

Data Management Plan

Project ID / OASIS ID

SUMO-20178 / sumogeop1-529524

Project Name

Bosworth Lane, Newbold Verdon

Project Description

Detailed magnetic survey over approx. 8.5ha

Client

Orion Heritage Ltd

Project Manager

Thomas Cockcroft

Field Leader

Simon Lobel

Date DMP created

13.11.2.24

Date DMP last updated

25.11.2024

Version

2

Technique - data

Detailed magnetic survey.

Manual – cart - other

Documentation and metadata

All documentation and data produced are stored on SUMO servers in a specific job file.

Data storage, access and back-up

- SUMO Secure server during the project life set up in a RAID configuration (a RAID configuration incorporates a level of data redundancy meaning if a single hard drive in fails data can still be restored).

- Snap shots of the data will be made at several intervals during the day to allow data to be restored for up to 30 days if changed / deleted.
- Once the final report has been completed data will be moved onto NAS drive set up in a RAID configuration.
- All data is backed up to an off-site location (Cloud storage).

Archive Selection Strategy

Digital Data

Selection

It is proposed that only the final version of all born digital documents (reports, images and CAD files) will be selected for inclusion in the Preserved Archive. All raw and processed survey data will be included in the preserved archive. Below is what will constitute the selected archive:

- Raw data in XYZ format .csv and .png plus .pgw world file
- Processed data as .png plus .pgw world file
- Final survey report .pdf
- CAD and Vector graphics (interpretations) in .dwg format

De-selected digital data

The de-selected material will be retained on the SUMO Secure server and Cloud storage.

Documents

Not applicable – no archive

Materials

Not applicable – no archive

- Archaeological Geophysics
- Engineering Geophysics
- Measured Building Services
- Utility and Topographic Services
- Aerial Surveys
- Rail Surveys

SUMO GeoSurveys is a trading name of SUMO Geophysics Ltd.
SUMO Services Ltd, incorporated under the laws of England and Wales,
Company Registration No.4275993.
Registered Office Unit 8 Hayward Business Centre, New Lane, Havant, Hampshire, PO9 2NL