# GEOPHYSICAL SURVEY REPORT G1579

## Bridgeman's Field, Gatcombe Farm, Long Ashton, North Somerset

**Client:**

**The Long Ashton Land Company**

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# GSB Survey Report No. G1579

## Bridgeman's Field, Gatcombe Farm, Long Ashton, North Somerset

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### Survey Personnel


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Project Assistants: Rachel Brown BA, Mai-Ly Dubreuil, Alistair Galt BA MSc, Joe Perry BA, Claire Stephens BA MA.


### Dates

Fieldwork: 29th June - 8th July 2015
Report: 16th July 2015

**Report Approved:** Dr John Gater MCIfA FSA

## Background Project Details

| | |
|---|---|
| **NGR** | ST 530 699 |
| **Location** | The site is located approximately 5 km to the south-west of Bristol, on the western edge of the village of Long Ashton. The survey area comprises two fields located to the north of Weston Road. |
| **HER/SMR** | Somerset HER |
| **District** | North Somerset |
| **Parish** | Long Ashton |
| **Topography** | The site slopes gently down from 66m Above Ordnance Datum (AOD) in the north to 50m AOD in the south. |
| **Current Land Use** | Arable |
| **Soils** | Whimple 1 (572d): argillic brown earths, reddish fine loamy over clayey soils (SSEW 1983). |
| **Geology** | Mercia Mudstone group (BGS 2015). |
| **Archaeology** | The survey site falls within the scheduled area of the Roman small town at Gatcombe (monument no. 1011978). The settlement was established in the Iron Age, was subsequently Romanised and occupied throughout the Roman period (Branigan 1977). Various phases of farmsteads were established and a substantial wall was built around the settlement towards the early fourth century (Cunliffe 1967, HE 2015). Previous works within the current survey area include a geophysical survey (Sabin and Donaldson 2012) and an archaeological evaluation by Cotswold Archaeology (CA) (2013). |
| **SMC ref.** | SL00107266 |
| **Survey Methods** | Detailed magnetometer survey (fluxgate gradiometer) and earth resistance survey. |
| **Study Area** | 5 ha |

## Aims

To locate and characterise any anomalies of possible archaeological interest within the study area. The works were conducted on behalf of **The Long Ashton Land Company**.

## Summary of Results

The geophysical survey has successfully identified anomalies of an archaeological origin within Area 1, the western portion of the site. The recorded responses accord with the previous geophysical survey results (Sabin and Donaldson 2012) with both the magnetic and resistance surveys detecting a late Iron Age/Early Romano-British period enclosure ditch. A second linear anomaly, located at the north of Area 1 and oriented east-west, was interpreted as part of a separate enclosure system that extends north of the current survey area. This was identified by the magnetometer survey only.

Further anomalies and trends interpreted as of an uncertain origin were detected by both techniques. These anomalies lack the spatial patterning of responses derived from archaeological features, however, an anthropogenic origin for some of the responses cannot be entirely ruled out. Where possible, these responses have been related to the results from the archaeological evaluation (CA 2013).

Responses attributed to agricultural features, underlying geological variation and modern ferrous debris and fencing have also been identified.

## Method

All survey grid positioning was carried out using Trimble R8 Real Time Kinematic (RTK) VRS Now GNSS equipment. The geophysical survey areas are georeferenced relative to the Ordnance Survey National Grid by tying in to local detail and corrected to the OS Mastermap provided by the client. These tie-ins are presented in Figure 2. Please refer to this diagram when re-establishing the grid or positioning trenches.

For the magnetic data collected with the cart system; all survey data points had their position recorded using Trimble R10 Real Time Kinematic (RTK) VRS Now GNSS equipment. The geophysical survey area is georeferenced relative to the Ordnance Survey National Grid.

| Technique | Instrument | Traverse Interval | Sample Interval |
|---|---|---|---|
| Magnetometer | CARTEASY$^N$ cart system (Bartington Grad 601sensors) | 0.75m | 0.125m |
| Resistance | Geoscan Research RM85/RM15+MPX (0.5m twin array) | 0.5m | 1m |

All survey work is carried out in accordance with the current English Heritage and Chartered Institute for Archaeology guidelines (IfA 2002, EH 2008, CIfA 2014).

## Data Processing

Data processing was performed as appropriate using both in-house and commercial software packages (GeoSuB, Geoplot, CARTEASY$^N$) as outlined below.

*Magnetic Data - CART*
Zero Mean Traverse, Gridding, Interpolation

*Resistance Data*
Normalisation, Despike, Grid Edge Match, Interpolation, High-Pass Filter

## Limitations

Magnetic survey is an exceedingly effective technique for site evaluation providing fast data acquisition and responding, to some degree, to the majority of archaeological site-types. The technique relies upon enhancement of naturally occurring iron-bearing compounds in the soil through anthropogenic activity. Detection rates can be poor where archaeological sites have only seen temporary and/or sporadic occupation or where there is insufficient activity to drive the enhancement; this is often true of Lithic-era sites. Success may also be limited over soils which are naturally deficient in iron compounds. Conversely, soils overlying (or derived of) naturally magnetic geological units, for example igneous formations, will produce strong responses which may mask subtler archaeological enhancement within.

The presence of ferrous structures above or below ground (buildings, pylons, fences, pipes etc.) will produce very strong magnetic fields extending far beyond their physical footprint. The strength of these magnetic 'shadows' is such that it will mask practically any archaeological anomalies. Similarly, later features and demolition spreads or imported consolidation material can produce areas of magnetic disturbance that will mask underlying features.

As a general rule, the Bartington Grad 601 sensors allow for a depth of investigation of approximately 1.0m, depending on the strength of the field produced by the buried feature; below this depth only particularly enhanced material will be detected with any kind of confidence.

Resistance survey relies upon the electrolytic passage of current through the ground and reflects the distribution of moisture across the area under investigation. Traditionally the technique is considered appropriate for the detection of high-resistance features, such as walls/foundations, and low resistance features (high-moisture content), such as ditches. However, as with all geophysical methods, the technique relies on a contrast being detectable between the features under investigation and the prevailing background conditions of the site. Moisture levels within the ground vary depending on the time of year, and the recent and current weather conditions, and these factors will all impact on the results of the survey.

The 0.5m Twin-Probe array is the most widely used configuration within the archaeological geophysics community and provides less ambiguous anomaly profiles than other available arrays. The depth of investigation is considered to be up to 1m, although results can sometimes be effected by deeper geological variation.

## Interpretation

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: *Archaeology* – *?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 *?Archaeology*. Details of the data plot formats and interpretation categories used are given in the Appendix: Technical Information at the end of the report.

## General Considerations

The ground conditions for the survey were generally good. The western field (Area 1) had been under hay and this had been recently cut. The eastern field (Area 2) had been under a bean crop and this again had been recently harvested. Both fields were very dry for the resistance survey, following a period of very hot weather, and this resulted in some poor electrical contacts. For the second week of the resistance survey, a more mixed weather prevailed with some rain facilitating better probe insertion and contact.

## 1.0 Survey Results - Magnetometer Survey

1.1 The survey results have identified anomalies of archaeological origin within the western portion of the survey area (Area 1) in both the magnetic and resistance data. Further responses of uncertain origin have also been recorded and an archaeological origin cannot be entirely dismissed for some of these anomalies. Responses interpreted as reflecting geological and agricultural features have also been recorded.

**Archaeology**

1.2 A curvilinear positive magnetic anomaly [**1**] detected in Area 1 extends from the north-east corner of the survey area southwards, and then curves around to the western survey boundary. This anomaly was detected by the earlier geophysical survey (Sabin and Donaldson 2012, Anomaly 7). Evaluation by CA (2013, 12) has determined the feature to be a ditch, part of a late Iron Age/Early Romano-British enclosure system.

1.3 A positive linear response, oriented east-west and located at the north of Area 1, appears to be part of a separate enclosure system that extends to the north of the current survey area. Again this enclosure has been evaluated and dated to the late Iron Age/Early Romano-British period (CA 2013, 13).

**Uncertain Origin**

1.4 At the south-east corner of curvilinear anomaly [**1**], a cluster of strong responses has been identified. These anomalies may represent industrial activity or material derived from such processes. No *in-situ* features were recorded by the evaluation (CA 2013), however, iron slag was recovered from the topsoil and this could account for some of the recorded responses. The presence of *in-situ* industrial features in this area should not be discounted.

1.5 Further discrete responses across the survey area may reflect negative features, such as pits, however their lack of spatial patterning precludes any firmer interpretation on their origin.

1.6 Weak linear trends within Area 2 also accord with previously investigated features. For example, a rectilinear arrangement of trends in the north-west of the area correlates with a number of undated ditches revealed by the evaluation. Similarly, in the south of Area 2, a series of roughly east-west oriented parallel linear trends reflect ditch features identified through aerial photography and determined to be of a modern provenance (CA 2013, 10).

1.7 Further highlighted trends within the data are likely to reflect natural features, for example geological variation, or agricultural features such as drains and plough furrows.

**Agricultural**

1.8 A linear positive response, located in the south of Area 2, and oriented roughly east-west, again accords with the aforementioned modern parallel ditches.

**Ferrous**

1.9 Strong responses from modern ferrous debris have been recorded across the site. These include discrete dipolar anomalies, derived from near-surface magnetic litter (for example brick, slag and iron/steel fragments) and also responses derived from the surrounding boundary fences. These responses are considered of little archaeological significance.

## 2.0 Survey Results - Resistance Survey

**Archaeology**

2.1 A high resistance curvilinear anomaly/trend [**A**] has been detected in the east of Area 1. This anomaly follows the course of magnetic anomaly [**1**] and is interpreted as the enclosure ditch. The high resistance nature of the anomaly reflects the dry ground conditions, with preferential drying of the near surface ditch fill.

**Uncertain Origin**

2.2 A broad cluster of large discrete high resistance anomalies have been recorded at the north of Area 1. These anomalies lack the morphological patterning that would hint at an archaeological origin; it is likely that these responses reflect geological variation and/or differential drainage of the site. These anomalies are located at the northern/higher end of the site and this is likely to be more freely draining. However, an archaeological origin for at least some of the responses, for example quarrying, is possible.

2.3 Similar background patterns in the resistance can be observed within Area 2, with higher resistance to the north and much lower resistance in the southern portion of the site.

2.4 At the south and west of Area 1, two weak high resistance linear/rectilinear anomalies have been identified. At the southern end of the site, a high resistance linear anomaly with a 90° turn is interpreted as relating to the modern linear anomalies in the south of Area 1 and also aligns with a field boundary depicted in the historic mapping (OS 2015).

2.5 A weak linear anomaly at the west of the site is aligned with the prevailing cultivation regimes and probably reflects an agricultural features. It is also located close to the southern half of one of the evaluation trenches (T7) and may be a product of the ground disturbance around the trench. Nevertheless, an archaeological origin should not entirely be discounted.

**Agricultural**

2.6 Linear high resistance anomalies in the south of Area 2 again correspond to the recorded magnetic anomalies and trends. These correspond to the earthworks identified in historic aerial photographs and relate to modern ditch features (CA 2013, 10).

2.7 Parallel high and low resistance trends and also curvilinear trends, following the course of the field boundary, have been detected across the survey area. These are interpreted as features derived from modern agricultural practices, for example plough furrows and tractor ruts.

**Disturbance**

2.8 Three areas of disturbance have been highlighted. These were characterised by poor probe contact and frequent spikes within the collected data suggestive of increased stone within the topsoil. It is unclear if this is a result of anthropogenic activity or natural pedological/geological variation. In Area 1, one of the identified areas accords with a rectilinear earthwork identified in the historic aerial photographs (CA 2013).

## 3.0 Conclusions

3.1 Anomalies of an archaeological origin have been detected in Area 1. The identified responses accord with the previous geophysical survey results (Sabin and Donaldson 2012) with both the magnetic and resistance surveys detecting a late Iron Age/Early Romano-British period enclosure ditch [**1/A**]. A second linear anomaly, interpreted as part of a separate enclosure extending into the field to the north of Area 1, was also detected by the magnetometer survey only.

3.2 Anomalies and trends of an uncertain origin were detected by both techniques. Where possible, these have been related to the results from the archaeological evaluation.

3.3 Further anomalies attributed to agricultural features, underlying geological variation and modern ferrous debris and fencing have also been identified.

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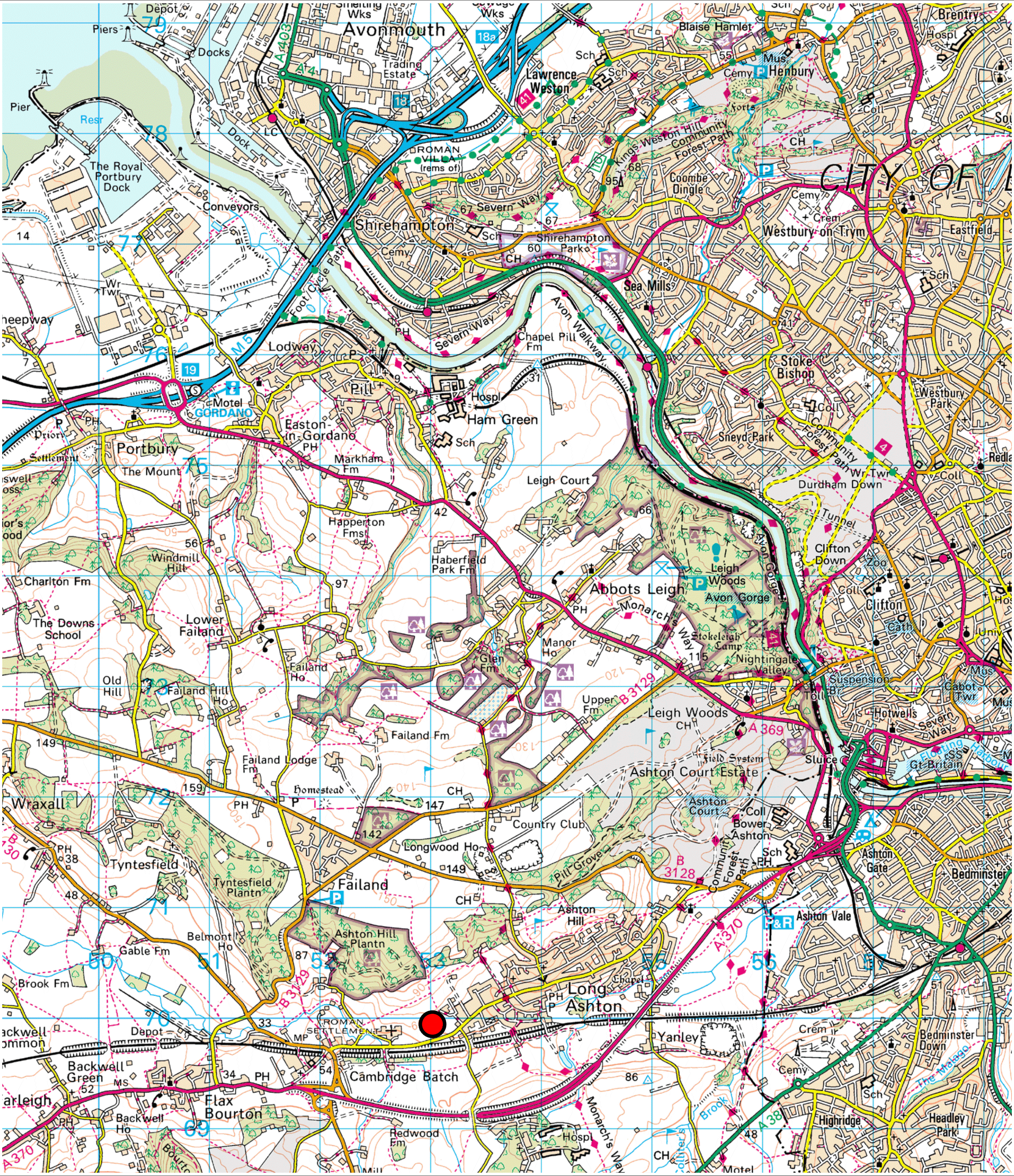


Site Location

0 metres 2000

1:50,000 @ A4

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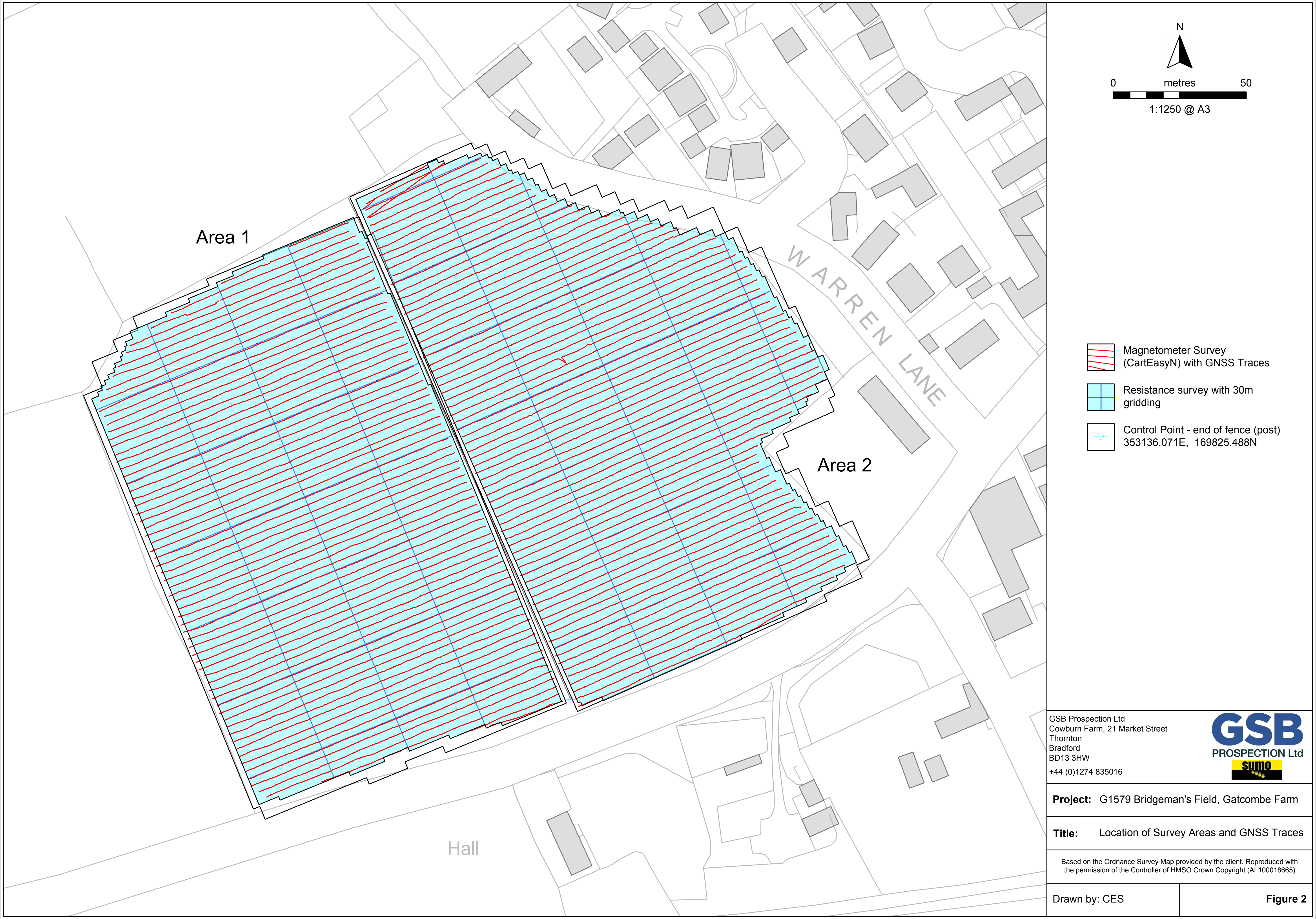
**Project:** G1579 Bridgeman's Field, Gatcombe Farm

**Title:** Site Location Diagram



Drawn by: JMT

**Figure 1**

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**Title:** Location of Survey Areas and GNSS Traces



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**Figure 2**



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**Title:** Magnetometer Survey - Greyscale Plots



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**Figure 3**



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**Project:** G1579 Bridgeman's Field, Gatcombe Farm

**Title:** Magnetometer Survey - Interpretation



Drawn by: CES

**Figure 4**


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**Title:** Resistance Survey - Greyscale Plots (Interpolated Data)



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**Figure 5**



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**Title:** Resistance Survey - Interpretation



Drawn by: CES

**Figure 6**


N

0 metres 50

1:1250 @ A3

+/-1SD

5

Ohms

-5


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**Project:** G1579 Bridgeman's Field, Gatcombe Farm

**Title:** Resistance Survey - Greyscale Plots (High-Pass Filtered (Gaussian weighting))



Drawn by: NT

**Figure 7**

## Appendix - Technical Information: Magnetometer Survey

### 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. 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.

### 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

| | |
|---|---|
| XY Trace Plot | This involves a line representation of the data. Each successive row of data is equally incremented in the Y axis, to produce a stacked profile effect. This display may incorporate a hidden-line removal algorithm, which blocks out lines behind the major peaks and can aid interpretation. The advantages of this type of display are that it allows the full range of the data to be viewed and shows the shape of the individual anomalies. The display may also be changed by altering the horizontal viewing angle and the angle above the plane. |
| 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. |
| 3D Surface Plot | This is similar to the XY trace, but in 3 dimensions. Each data point of a survey is represented in its relative position on the x and y axes and the data value is represented in the z axis. This gives a digital terrain, or topographic effect. |

**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* | 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. |
| *?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. |
| *Increased Magnetic Response* | An area where increased fluctuations attest to greater magnetic enhancement of the soils, but no specific patterns can be discerned in the data and no visual indications on the ground surface hint at a cause. They may have some archaeological potential, suggesting damaged archaeological deposits. |
| *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. |
| *Old Field Boundary* | Anomalies that correspond to former boundaries indicated on historic mapping, or which are clearly a continuation of existing land divisions. |
| *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. |
| *Ploughing* | Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes. |
| *Natural* | These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions. Smaller, isolated responses which do not form such obviously 'natural' patterns but which are, nonetheless, likely to be natural in origin may be classified as *?Natural*. |
| *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 *?Archaeology* and *?Natural* or (in the case of linear responses) *?Archaeology* and *?Ploughing*; occasionally they are simply of an unusual form. |
| *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. |
| *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. |

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).

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