



## BAINBRIDGE VILLAGE GREEN & QUAKER FIELD



**GEOPHYSICAL SURVEY**

**September 2017**

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## 1. Introduction

At the request of the Yorkshire Dales National Park Authority (YDNPA), Swaledale and Arkengarthdale Archaeology Group (SWAAG) has carried out geophysical surveys of three sites in Bainbridge as part of the “We Dig Community” project they are managing on behalf of the Yorkshire Dales Young Archaeologists Club.

The project is funded by YDNPA’s Sustainable Development Fund and the Roger Stott Community Grants.

Magnetic and earth resistance surveys were undertaken.

The surveys were carried out on Sunday 17 September 2017.

There had been rain showers overnight but on the day of the surveys the weather was dry, mild and initially overcast but became brighter into the afternoon.

This report describes the equipment and methodology used for the surveys and for the data analysis. The results of the surveys are presented together with an interpretative commentary. Each site is considered separately.

This report including the survey results may be used freely with appropriate accreditation;

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1. All reports produced by SWAAG (swaag.org) are ©swaag.org but can be freely used with accreditation.
2. All reports will be made available on swaag.org and through the OASIS project on the Archaeology Data Service.
3. The Google Earth images can be used but the ‘Google Earth and the secondary text’ must remain as part of each image.
4. The LIDAR images are Published by the Environment Agency and licensed under Open Government Licence.

## 2. Equipment and Methodology

Geophysical surveys were undertaken with a Bartington Grad601-2 Gradiometer and a Geoscan Research RM85 Resistivity Meter with a PA20 Probe Array.

Grids of 20 metres square for the magnetic surveys and 30 metres square for the resistance survey were set out using geometry and their precise locations were established with a Spectra Precision Promark120 Professional Grade GPS/GLONASS GNSS Receiver.

The following is a summary of the techniques and instruments used in the survey together with a summary of the data processing methodologies.

## Magnetometry

Instrument	Bartington Grad601-2 Gradiometer
Grid Size	20 metres by 20 metres
Sampling along the traverses	0.25 metres
Traverse intervals	1metre
Collection mode	Zig-Zag
Settings	Range 100nT; resolution 0.03nT
Direction of traverse	East – West

The raw data was downloaded into Terrasurveyor version 3.0.31.4. It was de-striped where necessary and then clipped and interpolated.

The data plots were imported into QGIS version 2.18.0, a free Open Source Geographic Information System programme, where it was superimposed on the grids located with the ProMark 120 GNSS (see below).

The processed survey data was superimposed on Google Satellite View images using the GNSS data to fix its position.

## Resistivity

Instrument	Geoscan Research RM85 Resistivity Meter & PA20 Probe Array
Array	Twin Parallel Probe, 4 probe
Probe Spacing	0.5 metre
Grid Size	30 metres by 30 metres
Sampling along the traverse	0.5 metre
Traverse intervals	1metre
Collection mode	Zig-Zag
Settings	Gain x10; Frequency 122.5Hz; Output 45V
Direction of traverse	East – West

The raw data was downloaded into Terrasurveyor version 3.0.31.4 then clipped and interpolated.

The data plots were imported into QGIS and manipulated as described above for the magnetometry.

### 3. Location

Bainbridge is located in Wensleydale in North Yorkshire to the south of the confluence of the River Bain and River Ure. The village is situated on the A684 about 5 miles east of Hawes and about 15 miles west of Leyburn.

The Roman fort of Virosidium lies immediately to the east of Bainbridge

**Site 1** forms part of the Village Green and is located to the south west of the A684. It is centred on Ordnance Survey grid reference SD 93390 90159.

**Site 2** forms part of the Village Green located to the north east of the A684. It is centred on Ordnance Survey grid reference SD 93403 90233.

**Site 3** is also located in the centre of Bainbridge to the north east of the Village Green. It is centred on Ordnance Survey grid reference SD 93440 90293.

Figure 1 is a Google Satellite image showing Bainbridge with the three survey area outlined in red.

Figure 2 is a LIDAR image of the site with the magnetic survey grids outlined in red and the resistance survey area outlined in blue.

### 4. Description of Sites

**Site 1** is an unenclosed grassed area forming part of the southerly section of the main Village Green and it slopes down from west to east. There are trees along the south and west boundaries and the 17th century Village Stocks are located in the centre of the site. It is surrounded on all sides by vehicular highways.

**Site 2** is an unenclosed grassed area forming part of the north eastern section of the main Village Green. It is level and at the time of the survey was being used as a junior football area. The site adjoins the A684 with access roads to housing and public toilets to the east and north.

**Site 3** known as Quaker Field is a small rough grassed paddock used for grazing sheep. It is close to the west bank of the River Bain and adjoins housing to the north and south east and public toilets to the south west. The boundaries mainly comprise dry stone walls but there is a metal fence on the western side.

There are indications that water, drainage and/or other service pipes and cables pass through all three sites.

The areas of the survey sites was as follows :

Magnetometry	Site 1	2,000 square metres
	Site 2	800 square metres
	Site 3	800 square metres
	Total	3,600 square metres
Resistivity	Site 3	1,350 square metres

## 5. Results and Discussion – General

Figure 3 shows the magnetic survey data from Sites 1 to 3 superimposed on a Google Satellite image.

Figure 4 shows shows the resistance survey data from Site 3 superimposed on a Google Satellite image.

A relatively high level of magnetic readings was found across all three sites and in fact it proved difficult when initially setting up the equipment to find the required quiet area where the readings between the sensors did not consistently vary beyond acceptable limits.

The range of magnetic readings typically expected for evidence of archaeological features is between  $-4\text{nT}$  and  $+8\text{nT}$ . The readings registered on these sites were generally found to be significantly higher.

This is probably attributable to the existence of pipes and cables and various other metallic objects on all of the sites and possibly also to the construction and use of the highways and accessways which surround and bisect the Village Green in particular. In addition the Village Green has obviously been a public access area for many years and consequently the presence of small metallic objects would not be surprising.

There are some parallel lines evident in the processed data plots for Sites 1 and 2. They represent relatively high magnetic readings and appear to mirror exactly the survey traverses. It is consequently thought that they represent the wider influence of the very strong magnetic responses produced by the pipes and other metallic concentrations nearby rather than being evidence of any archaeological interest.

## 6. Results and Discussion - Site 1

Figure 5 shows the raw data from the magnetic survey of Site 1.

Figures 6 and 7 show the same data clipped at  $-17.5\text{nT}$  to  $+35\text{nT}$  and  $-4\text{nT}$  to  $+8\text{nT}$  respectively in an attempt to see if there are any features of interest discernable.

The raw and processed data plots show a dense scatter of bipolar responses, possibly stray ferrous or iron objects, which are to be expected on a site of this nature (see comments in 5 above).

The red and blue colours in Figure 5 indicate full scale bipolar responses due to the presence of ferrous materials and probably indicate the route of iron water pipes

They also show the location of the Village Stocks located in the centre of one of the grids and a further magnetic object on the eastern edge of the same grid.

The strong bipolar readings registered dominate a large proportion of the site and mask the possible existence of any other features which may be present.

## **7. Results and Discussion - Site 2**

Figure 8 shows the raw data from the magnetic survey of Site 2.

Figures 9 and 10 show the same data clipped at -17.5nT to +35nT and -4nT to +8nT respectively in an attempt to see if there are any features of interest discernable.

The raw and processed data plots show a dense scatter of bipolar responses, possibly stray ferrous or iron objects, which are to be expected on a site of this nature (see comments in 5 above).

The red and blue magnetic colours in Figure 8 indicate full scale bipolar responses due to the presence of ferrous materials. They clearly show the routes of pipes and/or cables passing through the site, possibly the continuation of the iron water pipe referred to under Site 1 above.

Again the strong bipolar readings registered dominate a large proportion of the site and mask the possible existence of any other features which may be present.

## **8. Results and Discussion – Site 3**

### **Magnetic Survey**

Figure 11 shows the raw data from the magnetic survey of Site 3.

Figures 12 and 13 show the same data clipped at -17.5nT to +35nT and -4nT to +8nT respectively in an attempt to see if there are any features of interest discernable.

The strong magnetic response along the eastern edge of the site is due to the presence of a metal fence along the field boundary.

In Figure 13 faint parallel stripes are discernable and they could for example be due to ploughing or drainage. There also appears to be a curved feature at the north west corner of the northern grid. Otherwise there is no evidence of any other obvious features.

### **Resistance Survey**

Figure 14 shows the resistance survey raw data.

Figure 15 shows the same data clipped at +36 to +80 in an attempt to see if there are any features of interest discernable.

Ground resistance surveys detect areas of ground which retain moisture to a greater or lesser extent than their surroundings. The data obtained at Site 3 shows some possible features.

In Figure 15 there is an area of generally low resistance readings at the southern portion of the survey site but slightly higher readings within that area reveal a roughly square feature. In addition a linear feature can be seen heading northwards from the square shape. These readings could for example be consistent with the presence of robbed out walls and/or drainage trenches with only rubble remaining. The darker area in the centre of the square may also be rubble. The same features can be seen in the Lidar image at Figure 16.

In the northern portion of the survey site as shown in Figure 15 the possible curved feature referred to under Magnetism Survey above is evident and again can also be seen in the Lidar image at Figure 16.

The darker area in the western portion of the survey site as shown in Figure 15 indicates high resistance readings which may for example be attributable to the presence of rubble.

Archaeological excavation will be required to confirm and provide an explanation of the possible features identified within Site 3.

## **9. Acknowledgements**

The following SWAAG members conducted the surveys: Nigel Bailey, David Brooks, Andrea Dixon, Shirley Gale, Mike Keenan, Les Knight, Sue Knight, Rob Nicholson, John Russell, Jane Towler and Mike Walton.

The data processing was carried out by Mike Walton and the Lidar images were processed by Stephen Eastmead.

This report was written by Mike Keenan and Mike Walton.

Our thanks are due to the members and leaders of the Yorkshire Dales Young Archaeologists Club and the officers of the Yorkshire Dales National Park Authority with the support of the Sustainable Development Fund and the Roger Stott Community Grants for giving SWAAG an opportunity to undertake these surveys.

We also thank Bainbridge Parish Council and the Lords Trustees of the Manor for allowing the survey on Bainbridge Green and the Quaker Trust for allowing the survey on Quaker Field.

Report dated 3 November 2017

10. Illustrations



Figure 1 : Bainbridge survey areas shown over Google Satellite image.



Figure 2: Bainbridge survey areas shown over Lidar image



Figure 3 : Bainbridge magnetic survey data superimposed on Google Satellite image



Figure 4 : Bainbridge resistance survey superimposed on Google satellite image.

Magnetic Survey (20 metre grids)

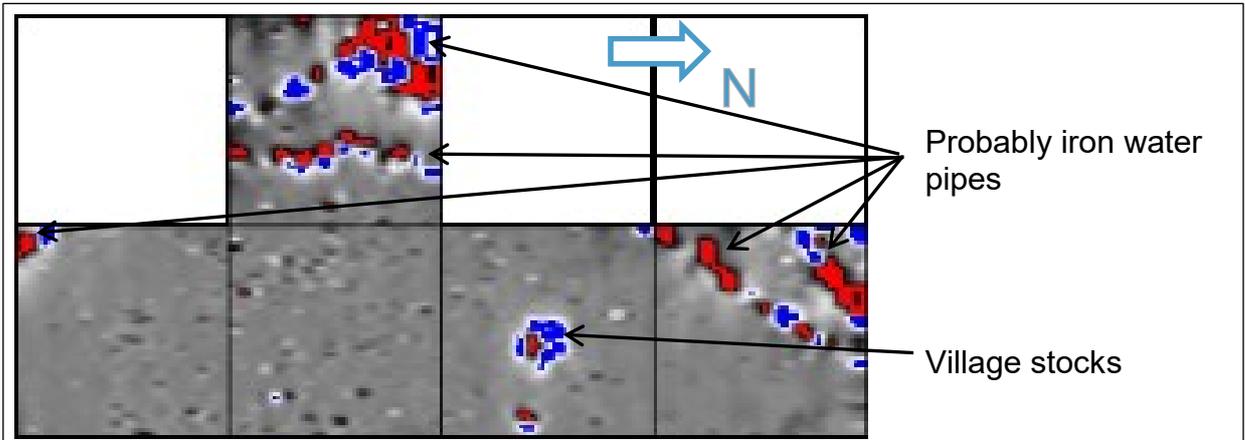


Figure 5 : Site 1, raw data, range -100nT to +100nT. Blue/Red areas indicate full-scale bipolar response due to ferrous materials.

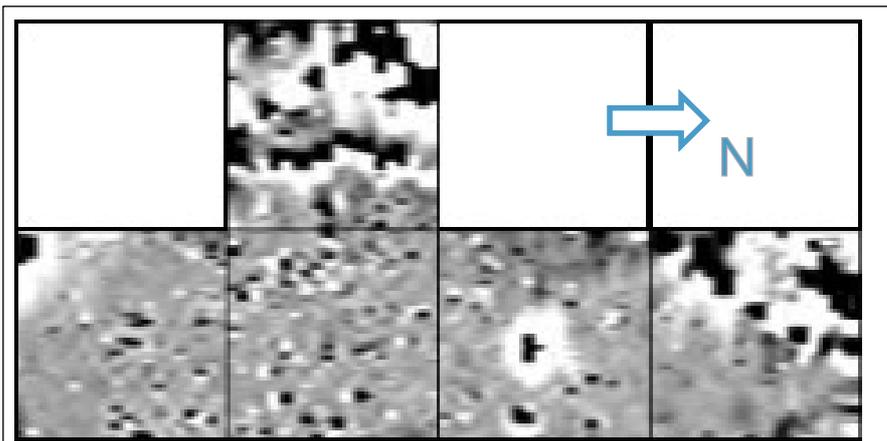


Figure 6 : Site 1, data clipped to range -17.5nT to +35nT

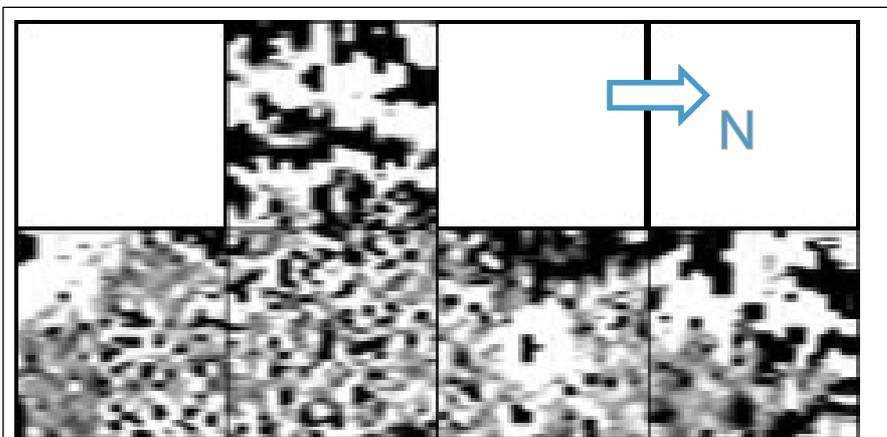
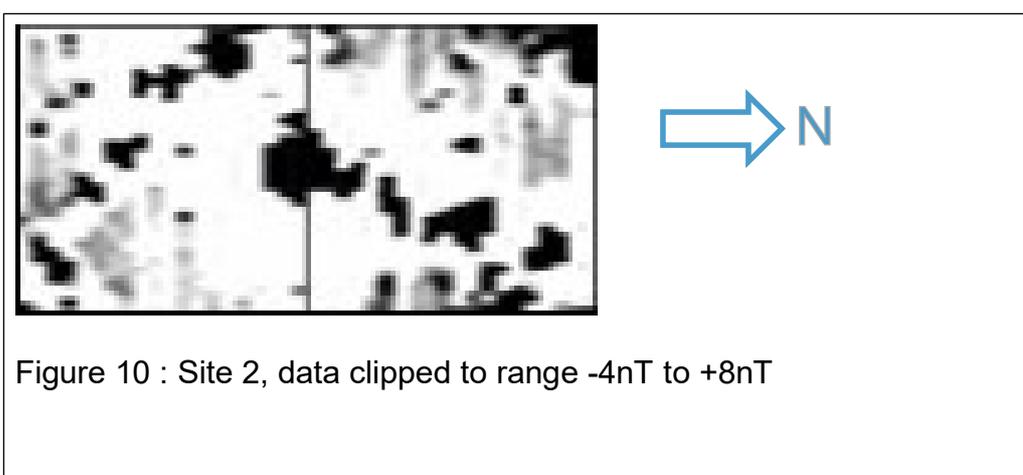
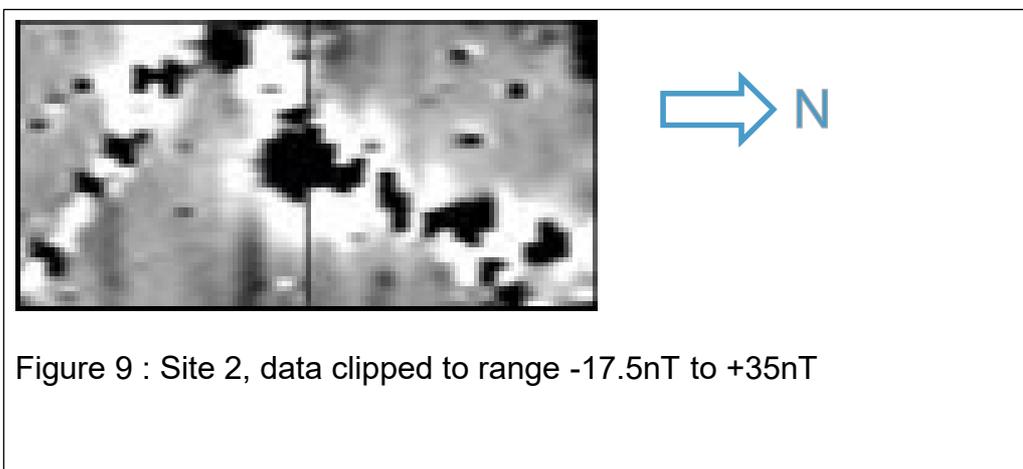
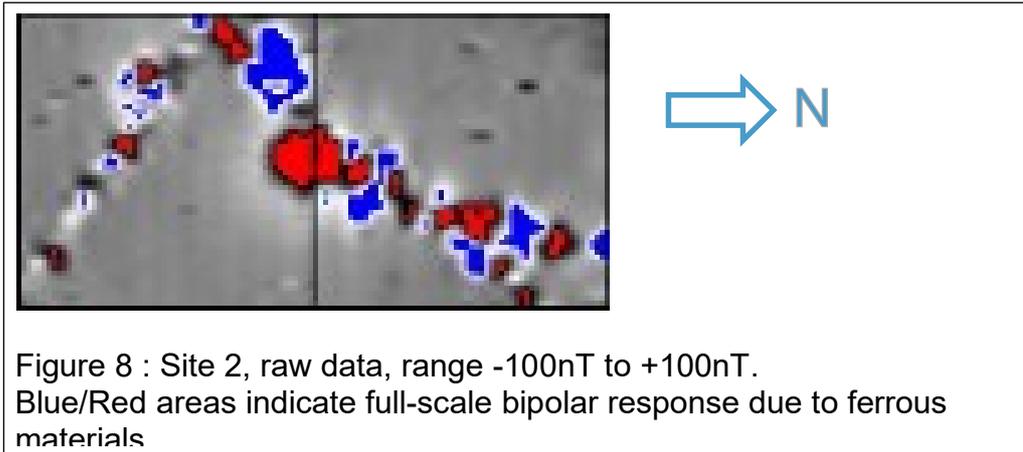
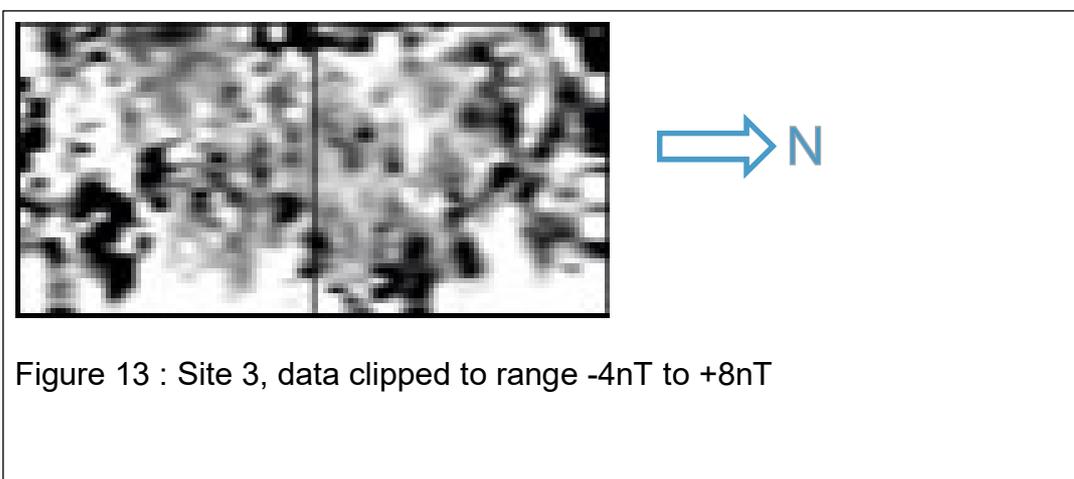
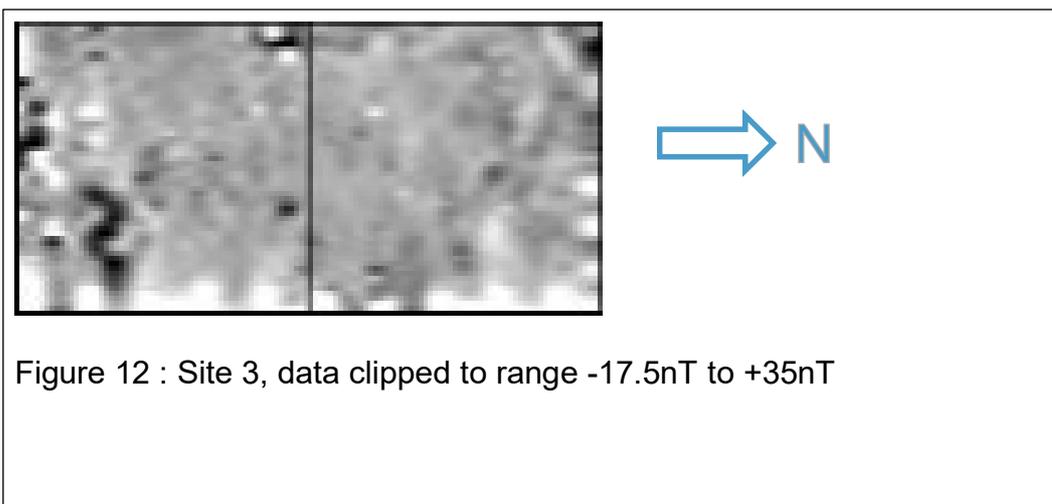
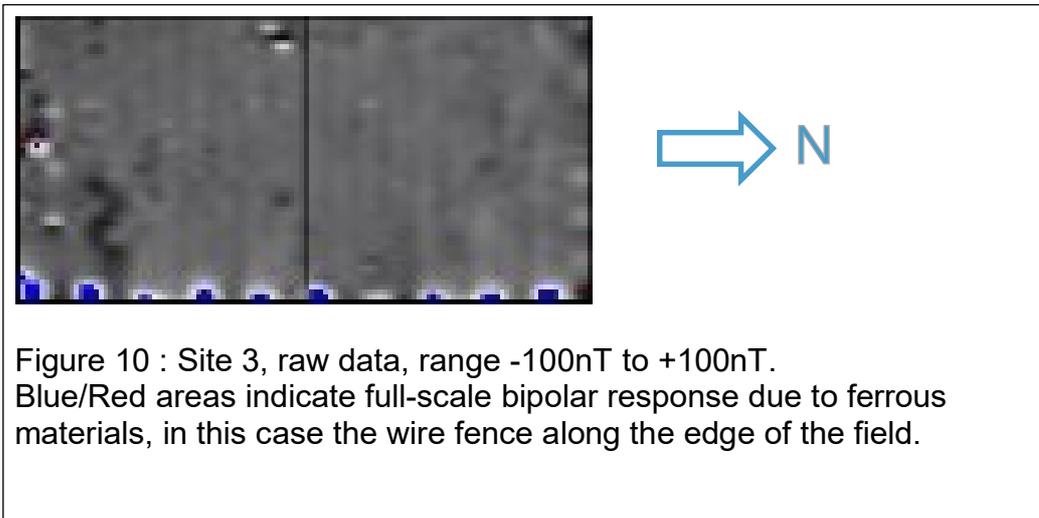
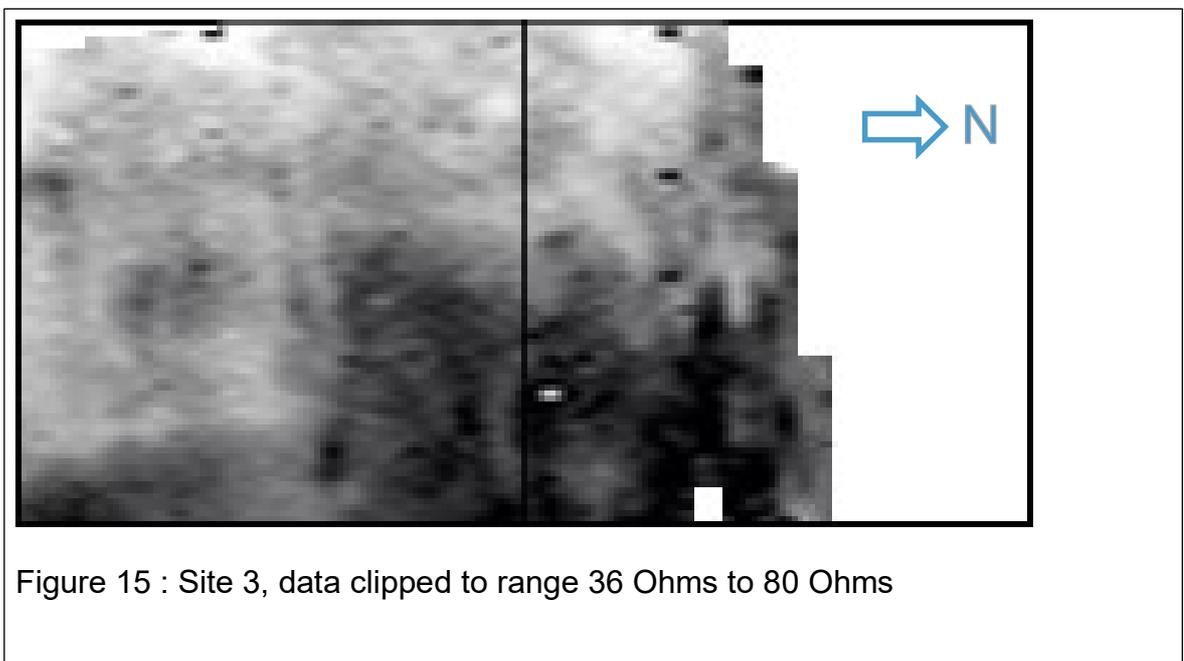
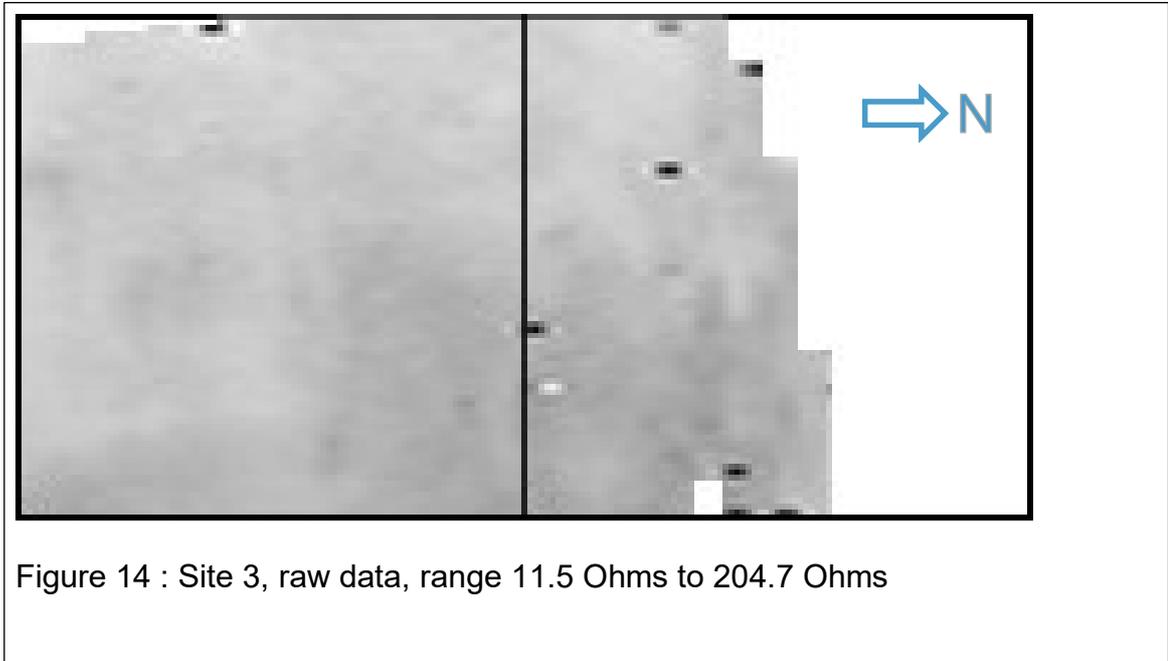


Figure 7 : Site 1, data clipped to range -4nT to +8nT





Resistance Survey (30 metre grids)



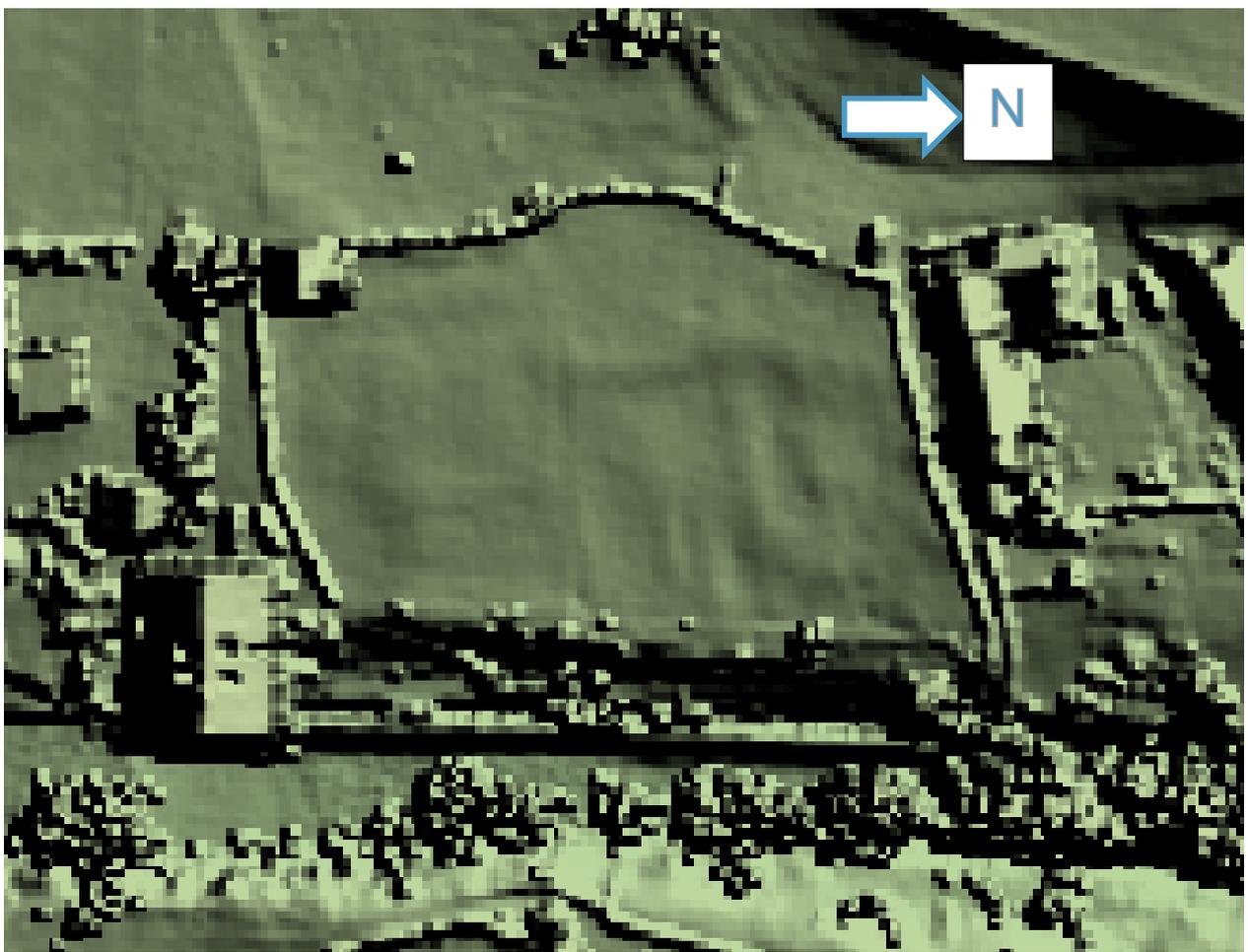


Figure 16 : Lidar image of Site 3 .