



# Wester Clevage Geophysical Survey

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## Data Report

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## Summary

*As part of the Strathearn Environs and Royal Forteviot (SERF) project a geophysical survey, using both resistivity and gradiometric techniques, was conducted at Wester Clevage, over an area where a possible enclosure had been recorded. The survey was undertaken on 7<sup>th</sup> and 8<sup>th</sup> July 2014. The main aim of the survey was to define the possible archaeological enclosure and record any unknown features. The results of the geophysical survey did not detect the enclosure and whether this feature actually exists has been put into doubt. Rig and furrow markings, also noted at the site, were identified.*

## 1.0 Introduction

A geophysical survey was carried out at Wester Clevage (NO 05003 14197, NMRS NO01SE 16), on 7<sup>th</sup> and 8<sup>th</sup> July 2014 as part of the SERF research project. The survey was also undertaken as a training exercise in geophysical techniques for students of the University of Glasgow.

### 1.1 Aims

The aims of the geophysical survey were:

- to detect and characterise any potential archaeological features in the area
- to continue to test the response of resistivity and gradiometry surveys within this landscape
- to compare the geophysical results with the aerial photographic data in order to build a more complete picture of the character of the archaeology
- to train students in the use and application of geophysics

### 1.2 Archaeological Description & Background

A possible enclosure was identified on series of four aerial photographs taken by RCAHMS in 1993 (see CANMORE, NMRS NO01SE 16) (see Figure 1 & 9). The possible enclosure appears as a faint ditched feature defined by discontinuous segments which curve around the contour of a small knoll. A covering of light snow highlights the line of the possible ditch at the W end; however, at the E end this line is continued as a possible slight bank. It measures approximately 140m NNE to SSW by 65m transversely with a possible entrance, 18m in width, on the W side. Aerial photos also show rig and furrow running across the field, one running NW-SE and the other – in the E end of the field, running NE-SW.

No evidence of the possible enclosure is depicted on the 1<sup>st</sup> edition of the Ordnance Survey map (OS 1862).

### 1.3 Geology, Topography & Vegetation

The underlying solid geology of Wester Clevage is sandstone (Scone Sandstone Formation) and the superficial geology is glacial till (BGS).

The enclosure is situated on low knoll, 150m above sea level, at the foot of the Cleavage Hills. The vegetation during survey was rough pasture.



*Figure 1: Aerial photograph of the possible enclosure at Wester Cleavage © RCAHMS*

## 2.0 Methodology

### 2.1 Survey Methodology

Two techniques of geophysical survey were employed: gradiometry and resistivity. The gradiometry survey was conducted using a dual sensor Bartington Grad 601. A gradiometer detects and records variations in relative magnetic strength across a surveyed area. Readings were recorded within 20m by 20m grids and taken every 0.5m (traverse) by 0.25m (sample). The total area surveyed by gradiometry was 16,000m<sup>2</sup> (see Figure 2).

Resistivity was measured within a smaller survey area. The resistivity survey was conducted using a GeoScan RM15 with 0.5m probe separation. By sending an electrical current between the probes

this technique records the relative electrical resistance across the survey area. Sixteen 20m by 20m grids (covering an area 6,400m<sup>2</sup>) was surveyed taking readings every 1m by 1m (see Figure 2).

The location of the survey grids were recorded using a Leica Viva dGPS and SmartNet.

## 2.2 Processing Methodology

The gradiometry survey data was downloaded using Grad 601 software and then imported into GeoPlot v3 for processing. Results were visualised as grayscale images and then georeferenced and interpreted in ArcGIS.

In order to reduce the effect of the very high magnetic readings the data was processed by setting the absolute readings to a minimum of -5nT and a maximum of +5nT. Furthermore, to compensate for the slight discrepancy between the 'balancing' of the two sensors of the Bartington Grad 601, which produced a 'striped' appearance, a 'zero mean' process was applied to all the grids. There was a staggered effect between the readings of individual lines due to the large number of measurements taken every metre and the difficulty of absolute consistency in the different surveyor's walking pace. Therefore a 'destagger' was applied to the data.

The resistivity data was downloaded directly into GeoPlot v3 software. Occasional spurious readings were corrected by a 'despike' process. An 'edge match' was applied to correct for the slight difference in the balance of the remote probes between the top and bottom rows. To heighten the contrast between the low and high readings the data was set to absolute readings between 15 and 65ohms.

## 3.0 Results

### 3.1 Gradiometry Survey

(Figures 3, 4 & 5)

The results of the gradiometric survey show a scatter of small dipoles (strong positive and negative anomalies) as well as just strong positive anomalies across the survey area. Although some of these readings may be ferrous metal objects (like pieces of agricultural equipment), they are most likely a response of magnetic stones within the glacial till, which have been spread by cultivation. Some of these anomaly clusters lie along the contours of the slope where they have collected or have been exposed.

Narrow linear bands of subtle magnetic strength, aligned from NW to SE, likely reflect cultivation of the field, corresponding to rig and furrow noted in the aerial photographs.

Evidence for the possible enclosure identified on the aerial photographs was not detected through the gradiometer survey.

### 3.2 Resistivity Survey

(Figures 6, 7 & 8)

Because the resistivity survey is more time consuming only a small area was sampled using this technique.

The results of this survey showed the general background readings to be of low resistance. Pockets of higher resistance are seen in the SE corner and middle of the survey area, which may reflect stonier variations in the glacial till. The wide band of very high resistance in the W end of the survey area is likely a response of the underlying geology, perhaps even the bedrock, which would be closer to the surface on the slope leading to the burn.

Narrow linear bands of high resistance, roughly 12-14m apart, extend across the survey area from NW to SE. These correspond to the rig and furrow noted from aerial photographs.

A 3m wide high resistance band, running down slope from the S side of the survey area for 20m is interpreted to be a drain or 'soakaway'.

### 4.0 Discussion & Conclusions

Neither the gradiometric or resistivity survey has detected the possible enclosure noted on the aerial photographs. This feature had only been identified during one aerial sortie. The signs for the enclosure, both slight ditch and bank, were unclear. It is unlikely these marks relate to an enclosure and may in fact be relict tracks relating to more recent agricultural activities. However, it should be noted that absence of evidence in the geophysical survey does not conclusively mean that the enclosure does not exist. It only means, that if an enclosure is present, that it is not distinct in terms of magnetism or resistance to the surrounding environment.

The survey, confirming the evidence from aerial photographs, demonstrated the field was cultivated by rig and furrow of unknown date.

### 5.0 Acknowledgements

The author would first like to thank Mr. Brian Henderson of Wester Clevage for kindly giving us permission to conduct this survey. Thanks to the surveyors - students from the SERF field school- Traci Billings, Alistair Branagh, Hunter Burgess, Sarah Huston, Veronika Kruspanova, Jacqueline Lemay, Stein-Kato Lindberg, Catriona Martin-Lennie, Kathleen McCaskill, Rory Peace, Ian Perry and Leonie Teufel. Also, thanks to Gert Petersen and Lorraine McEwan for their support and assistance in surveying and training. SERF is sponsored by Historic Scotland.

## 6.0 References

BGS (British Geological Survey) 1:50,000 solid & superficial geology maps:  
sc048w\_perth\_v6\_bedrock\_geology, accessed digitally through EDINA Digimap November 2014.

CANMORE Wester Clevage, NMRS NO01SE 16  
<http://canmore.rcahms.gov.uk/en/site/93618/details/wester+clevage/>

OS 1862 1<sup>st</sup> edition map 6inch to a mile.

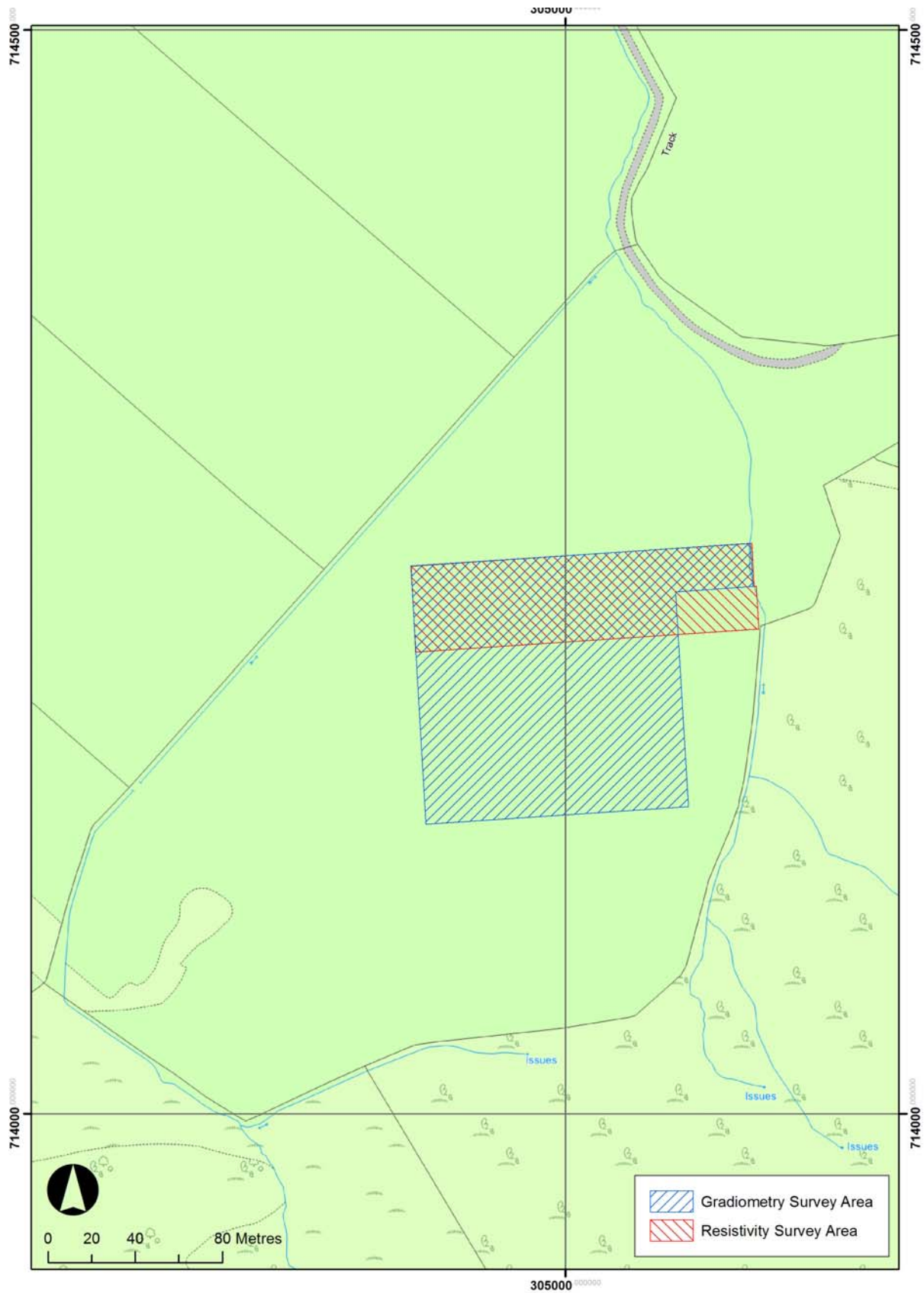


Figure 2: Location of the geophysical survey areas (OS mapping from EDINA Digimap)



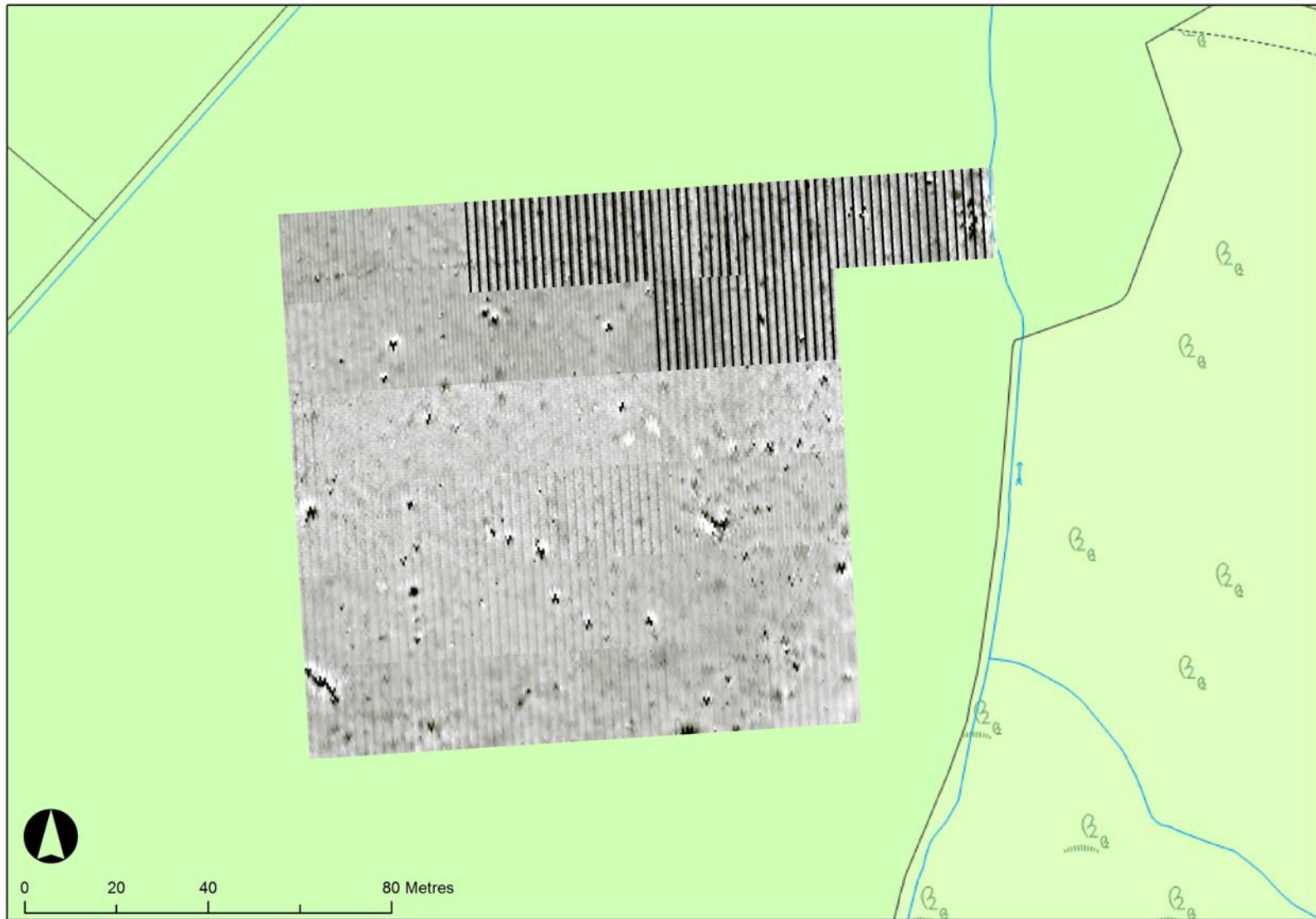


Figure 3: Raw gradiometry data

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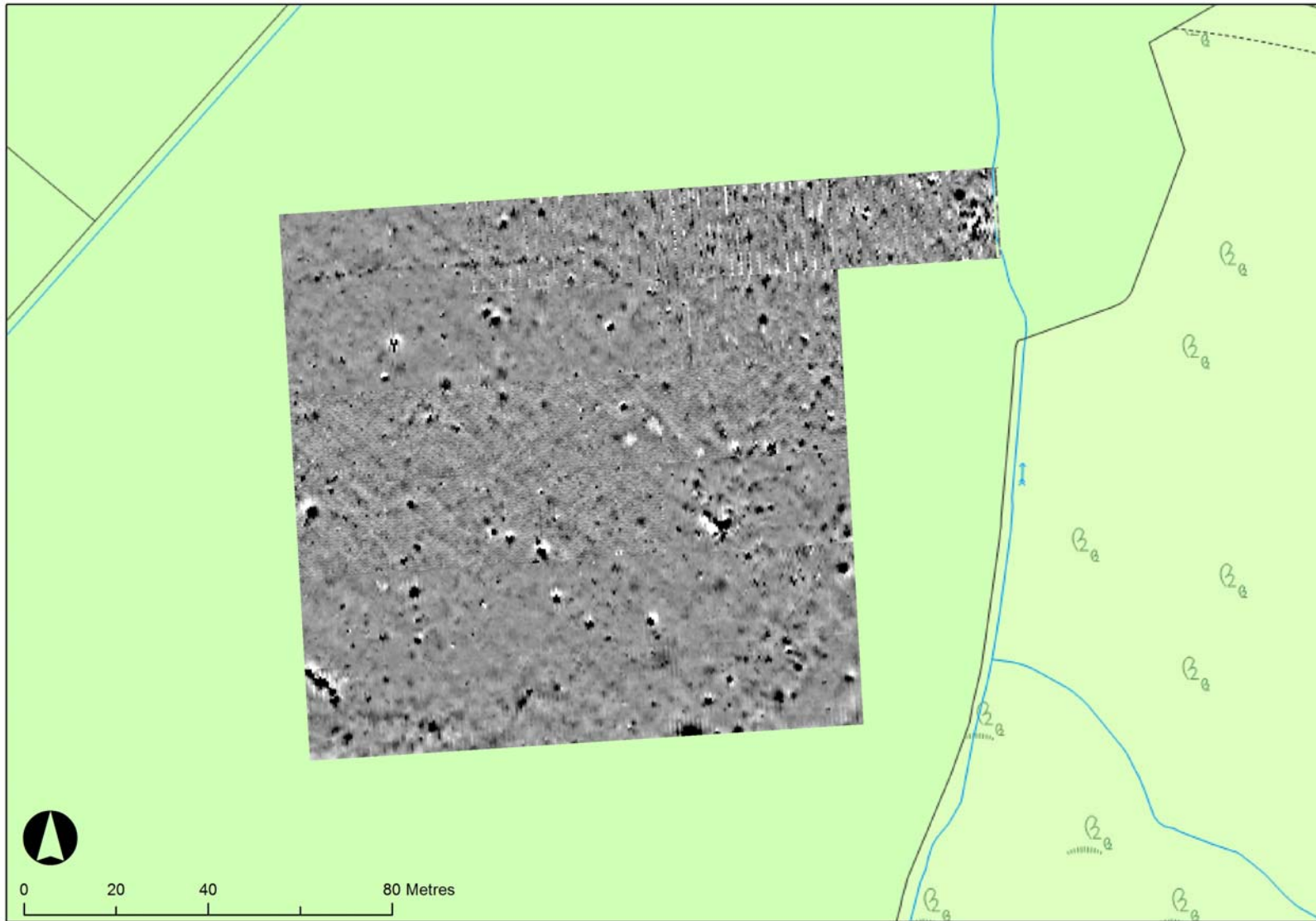


Figure 4: Processed gradiometry data

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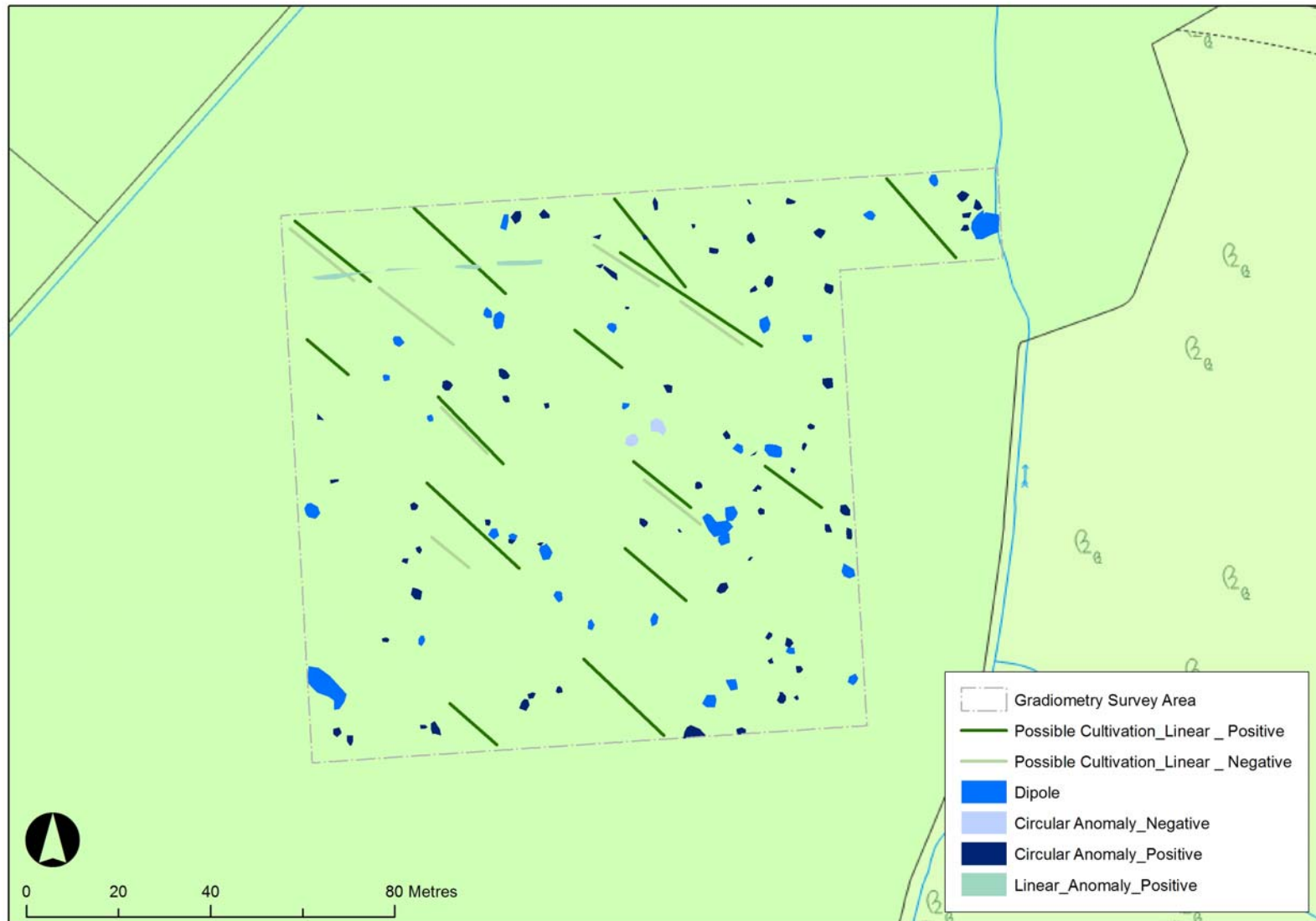


Figure 5: Interpretation of processed gradiometry data

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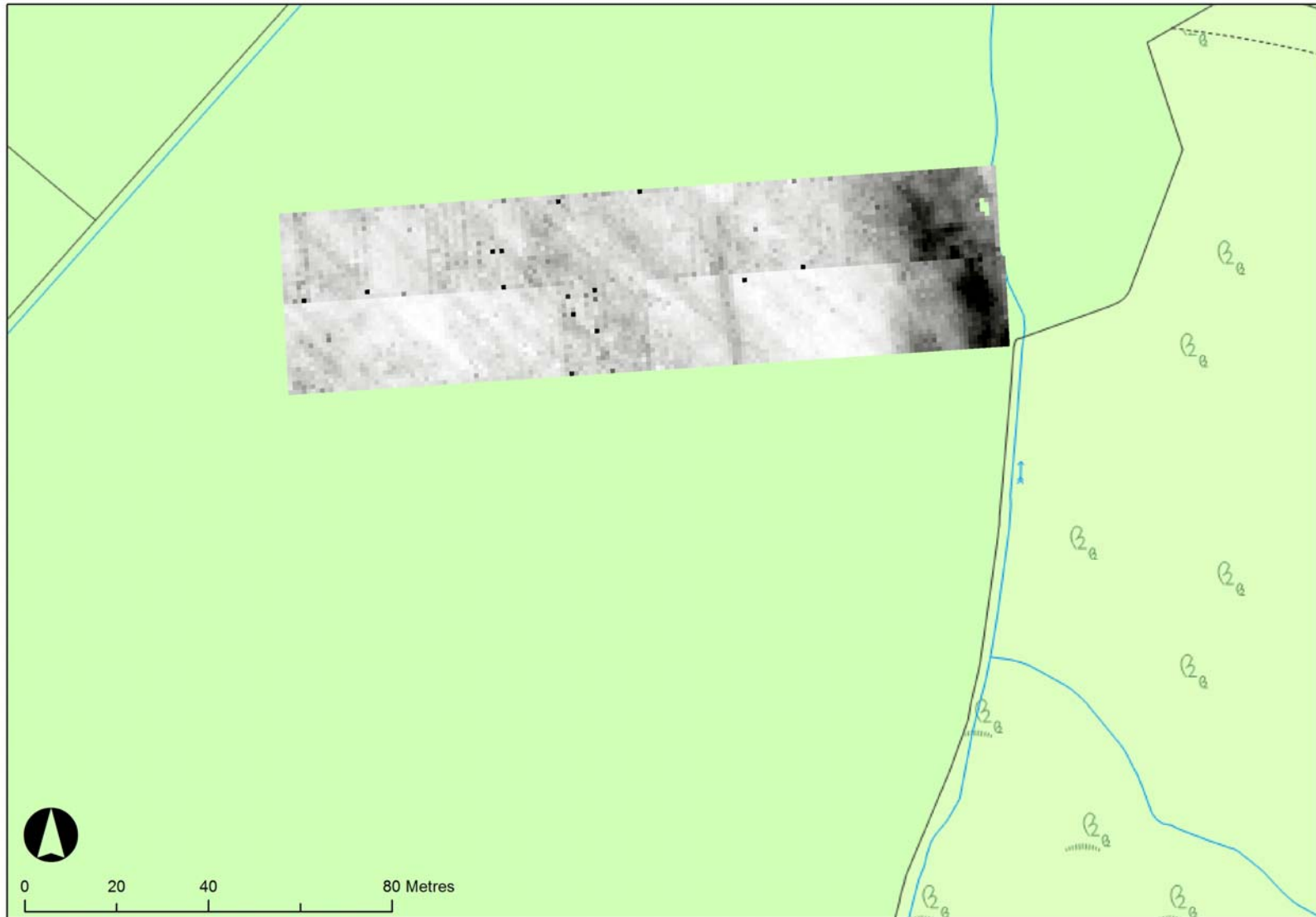


Figure 6: Raw resistivity data

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Figure 7: Processed resistivity data

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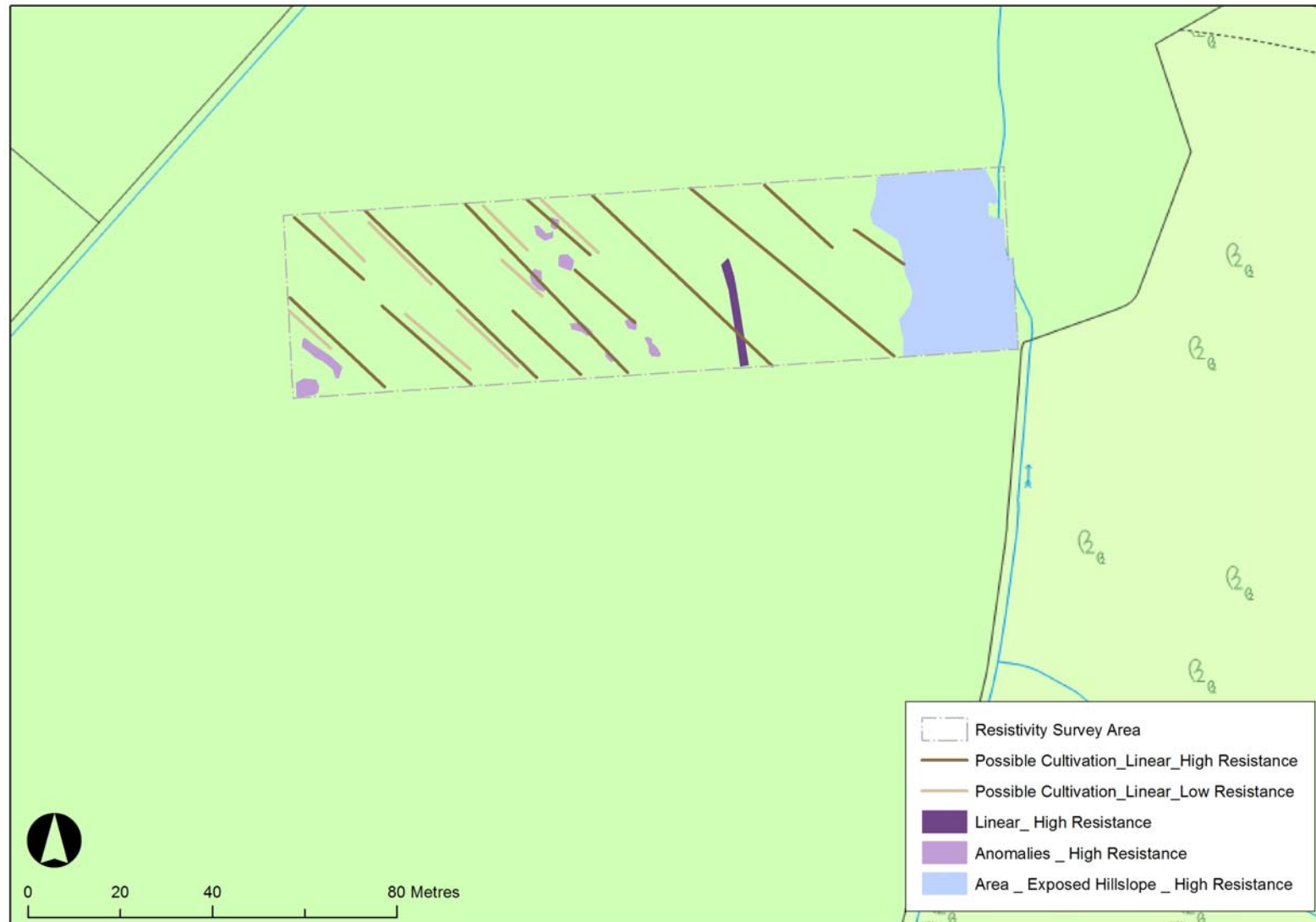


Figure 8: Interpretation of resistivity data

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Figure 9: Location of possible enclosure in relation the survey area (aerial transcription ©RCAHMS)