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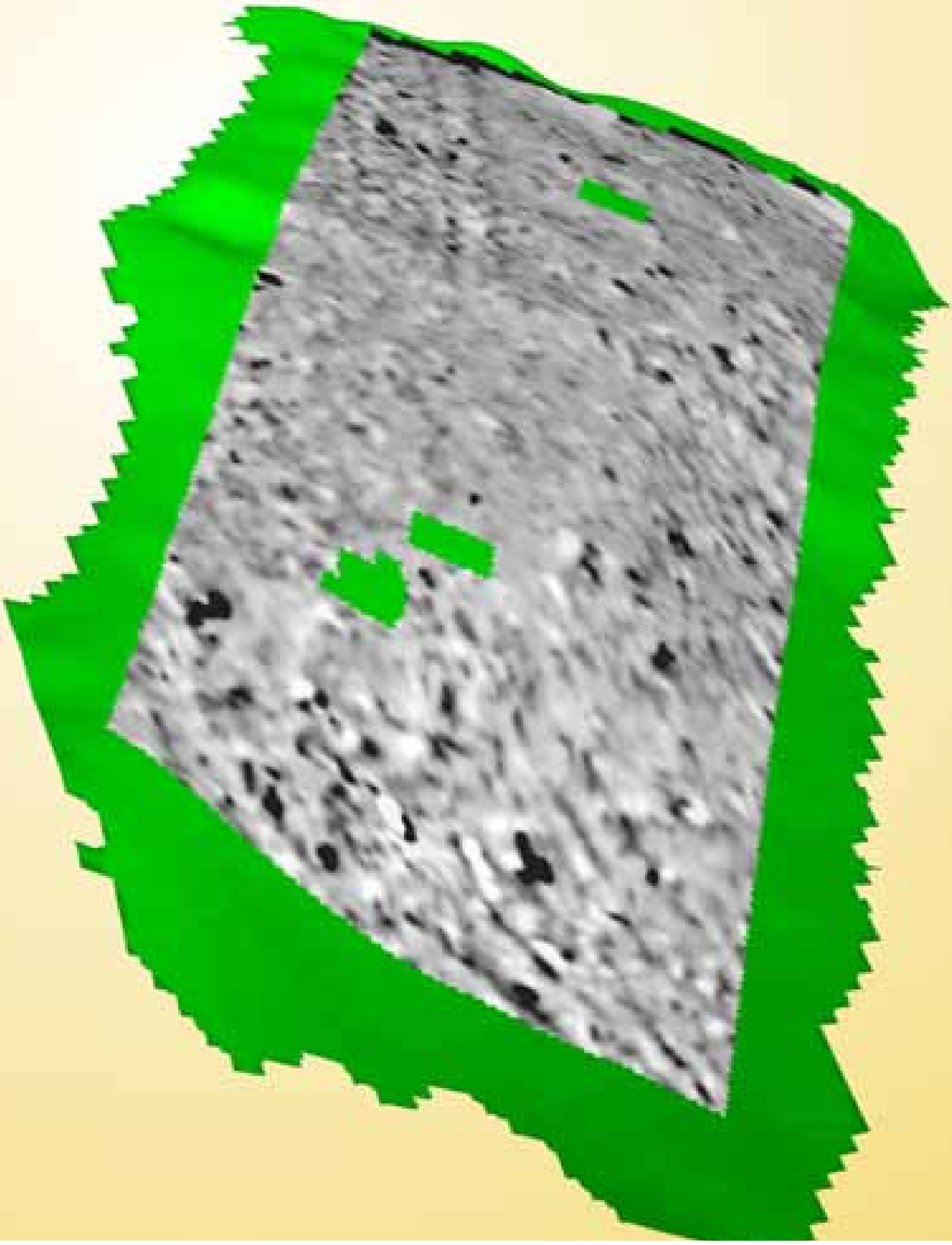
PIGGLEDENE, NORTH FARM, OVERTON, WILTSHIRE
REPORT ON GEOPHYSICAL SURVEY, SEPTEMBER 2008

Neil Linford



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SUMMARY

A geophysical survey was conducted at Piggledene, North Farm, Overton, Wilts., over the proposed site of a field experiment to determine a model for the formation of the old land surface layer observed during recent excavation at Silbury Hill. Soils at the site match parent material underlying the old land surface layer at Silbury and the current geophysical survey was requested to select an area with a minimal likelihood of disturbing any existing archaeological remains. Magnetic survey undertaken with fluxgate gradiometers revealed a number of linear anomalies, possibly associated with a late-prehistoric field system or, more probably, medieval ridge and furrow. Other discrete pit-type responses and negative linear anomalies were recorded, but these are probably related to field clearance activities. The survey has identified a suitable area for establishing the field test site and confirmed, through a topographic survey, that the slope of the terrain falls within the desired range for the experiment.

CONTRIBUTORS

The field work was conducted by Neil Linford, Paul Linford and Andy Payne.

ACKNOWLEDGEMENTS

The author wishes to thank Gill and Robin Swanton for allowing access to their land for the survey to take place, and for assistance both in the field and with supply of information for the interpretation of the data. The cover photograph shows a false perspective view of the magnetic survey data shown as a greytone image draped over a digital terrain model of the site.

ARCHIVE LOCATION

Fort Cumberland.

DATE OF FIELDWORK AND REPORT

The fieldwork was conducted on the 15th and 16th of September 2008 and the report was completed on 3rd October 2008.

CONTACT DETAILS

Dr Neil Linford, Geophysics Team, English Heritage, Fort Cumberland, Fort Cumberland Road, Eastney, Portsmouth PO4 9LD.
Tel: 02392 856761. Email: neil.linford@english-heritage.org.uk

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INTRODUCTION

During the recent excavations at Silbury Hill a thin grey stoneless layer overlying the clay-with-flints subsoil was identified as the old land surface, although it is unclear exactly how this layer was formed. An experiment has been proposed to investigate the action of repeated foot trampling and rain action on a similar clay-with-flints subsoil to determine whether this presents a valid process model for the creation of the old land surface layer (Canti 2008). To this end a test site with suitable geology and an angle of slope matching that of the old land surface was identified in a field known as Piggledene at North Farm, Overton, 3km E of Silbury Hill. Given the location of the farm, the majority falling within the Avebury World Heritage Site, a geophysical survey was requested to ensure the experimental test site (covering an area of approximately 6m x 12m) would be unlikely to impinge upon any significant archaeological activity. A further aim of the geophysical survey was to confirm, on the ground, that the angle of slope in the field originally identified from lidar data (Colin Shell *pers. comm.*) falls within an acceptable range between 3.2° and 4.7°.

The site is centred on a north-facing slope at SU 139 691 within the North Wessex Downs Area of Oustanding Natural Beauty, immediately above a dense scatter of sarsen stone, known locally as "grey wethers", found along the valley bottom within an adjacent Site of Special Scientific Interest in the ownership of the National Trust. A suitable shallow layer of clay-with-flints was identified at the site from field profiles, developed over Upper Cretaceous chalk (British Geological Survey of Great Britain 1974; Canti 2008). Weather conditions were dry and sunny throughout the survey.

METHOD

A survey grid was first established over the site using a Trimble kinematic differential global positioning system (GPS).

Magnetic survey

Bartington *Grad601* fluxgate gradiometers were used to conduct a magnetic survey over all of the accessible areas shown on Figure 1, following the standard method outlined in note 2 of Annex 1. Magnetic survey has been used successfully in the vicinity of the site (Linford 2004) and would be expected to detect some indication of archaeological remains, if present.

A plot of the magnetic data superimposed over the Ordnance Survey (OS) base map is shown on Figure 2 and as an X-Y traceplot and linear greyscale image on Figure 3. The only corrections made to the measured values displayed in the enclosed plots were to zero-mean each instrument traverse to remove the directional sensitivity and drift of the instruments, and to curtail the response of near surface ferrous detritus, through the application of a 2m x 2m thresholding median filter (Scollar *et al.* 1990: pp492). To improve the visual clarity of the traceplot presented in Figure 3(A), extreme values have been truncated to a range of ±200nT/m.

Angle of slope

An approximation to the angle of slope across the site was calculated from an interpolated digital terrain model (DTM), captured by a GPS topographic survey at an approximate sample spacing of 2m. The horizontal gradient of the DTM was determined in two orthogonal directions (0° N and 90° E) and an estimate of the slope angle was then derived from the square root of the sum of these two components squared. Figure 4 shows the resulting slope angle (degrees) plotted as a false colour image superimposed over the OS base map. Two false perspective views of the magnetic data draped as a greytone image over the DTM are shown in Figure 5.

RESULTS

A graphical summary of the anomalies discussed in the following text, superimposed on the base Ordnance Survey map data, is provided in Figure 6.

General magnetic response and modern interference

The background magnetic response at the site is relatively subdued, with the majority of readings (excluding extreme values) falling within a range of ±1.0nT/m (Figure 3(B)). Some localised magnetic variation is visible as a mottled appearance across the greytone image of the data when plotted with a linear scale between ±3.0nT/m; this may well reflect the differing depth of the clay-with-flints cover across the site. Modern disturbance is limited to the wire fencing to the E of the survey grid and a scatter of near surface ferrous detritus, giving rise to isolated high magnitude responses that have been suppressed by filtering in the final data-set.

Significant anomalies

Magnetic data

Despite the quiet background response a number of linear and discrete magnetic anomalies have been identified in the survey data. Two groups of linear anomalies [m1] and [m2] are found in areas of slightly enhanced background variability (most clearly visible in the traceplot, Figure 3(A)) and are distinguished by their magnetic response. The weak, diffuse, positive anomalies [m1] to the W of the survey area run on an EW alignment along the top of the down and are probably associated with either a presumed late-prehistoric field system or medieval ridge and furrow, both previously mapped through aerial photography (NMR No. SU 16 NW86). Given the diffuse nature of [m1] interpretation as ridge and furrow seems most likely.

The second group of linear anomalies, a series of more subtle negative responses [m2], run down the steep slope of the valley to the E in an area where a greater concentration of sarsen stones are found (Figure (5(B)). It is, perhaps, possible that [m2] are due to scour marks from the deliberate clearance of sarsen stones dragged into the valley bottom from level field plots on the top of the down. One further diffuse, positive linear anomaly [m3] is partially described within the SE corner of the survey and whilst this may represent an additional prehistoric field boundary, it is too incomplete to suggest a more definitive interpretation.

A scatter of discrete pit-type anomalies are found across the site, although the archaeological significance of these is difficult to fully ascertain; they may also be related to the removal of either sarsen stones or the more dense cover of vegetation in this area shown on historic OS mapping (OS Historic Mapping County Series: Wiltshire 1887, 1900 and 1924 (1:2500)). The group of pit-type responses to the NW at [m4] is possibly aligned down the slope of the hill and cuts through a highly tentative, rectilinear anomaly [m5]. Whilst [m5] may represent a shallow enclosure ditch, the weak nature and alternating polarity of the response question the fidelity of this interpretation.

Topographic data

Figure 4 illustrates the varying angle of slope across the site and the quite steep increase in gradient from the level top of the down into the valley bottom below. Values within the acceptable range of slope for the proposed experimental site are found mainly to the NE of the survey area. Few significant features have been captured by the relatively coarse ground based topographic survey, possibly due to the influence of historic ploughing across the site. However, an approximately NS orientated bank and ditch, possibly a field boundary or hollow way, are visible and it would appear that [m1] respects the position of this topographic feature (e.g. Figure 5(A)).

CONCLUSION

The magnetic survey at Piggledene has, perhaps not surprisingly given the location, successfully identified a number of anomalies that may well be of some archaeological significance. On the whole these anomalies would appear to be related to either a late-prehistoric field system or, more likely from the diffuse geophysical response, a pattern of presumably medieval ridge and furrow. However, immediately to the N of this ridge and furrow lies an area of more limited archaeological activity within the acceptable range of slope values to suit the proposed experimental test site. A highly tentative, ditch-type magnetic anomaly has been found in this area, although some form of invasive investigation would be required to confirm the significance of this response.

LIST OF ENCLOSED FIGURES

REFERENCES

British Geological Survey of Great Britain 1974 Marlborough, England and Wales, Sheet 266. British Geological Survey. 1:63360

Canti, M 2008 *'Understanding the old land surface at Silbury Hill: a project design for experimental studies, September 2008'*. English Heritage Research Department Project Design.

Linford, N 2004 *'Headlands Enclosure, West Overton, Wiltshire: Report on geophysical survey, November 2003'*. English Heritage Centre for Archaeology Report 19/2004.

Scollar, I, Tabbagh, A, Hesse, A and Herzog, I, Eds. 1990 *Archaeological Prospecting and Remote Sensing*. Topics in Remote Sensing. Cambridge, Cambridge University Press.

ANNEX 1: NOTES ON STANDARD PROCEDURES

1) Earth Resistance Survey: Each 30 metre grid square is surveyed by making repeated parallel traverses across it, all aligned parallel to one pair of the grid square's edges, and each separated by a distance of 1 metre from the last; the first and last traverses being 0.5 metres from the nearest parallel grid square edge. Readings are taken along each traverse at 1 metre intervals, the first and last readings being 0.5 metres from the nearest grid square edge.

   Unless otherwise stated the measurements are made with a Geoscan RM15 earth resistance meter incorporating a built-in data logger, using the twin electrode configuration with a 0.5 metre mobile electrode separation. As it is usually only relative changes in earth resistance that are of interest in archaeological prospecting, no attempt is made to correct these measurements for the geometry of the twin electrode array to produce an estimate of the true apparent resistivity. Thus, the readings presented in plots will be the actual values of earth resistance recorded by the meter, measured in Ohms (Ω). Where correction to apparent resistivity has been made, for comparison with other electrical prospecting techniques, the results are quoted in the units of apparent resistivity, Ohm-m (Ωm).

   Measurements are recorded digitally by the RM15 meter and subsequently transferred to a portable laptop computer for permanent storage and preliminary processing. Additional processing is performed on return to the Centre for Archaeology using desktop workstations.

2) Magnetic Survey: Each 30 metre grid square is surveyed by making repeated parallel traverses across it, all parallel to that pair of grid square edges most closely aligned with the direction of magnetic N. Each traverse is separated by a distance of 1 metre from the last; the first and last traverses being 0.5 metre from the nearest parallel grid square edge. Readings are taken along each traverse at 0.25 metre intervals, the first and last readings being 0.125 metre from the nearest grid square edge.

   These traverses are walked in so called 'zig-zag' fashion, in which the direction of travel alternates between adjacent traverses to maximise survey speed. Where possible, the magnetometer is always kept facing in the same direction, regardless of the direction of travel, to minimise heading error. However, this may be dependent on the instrument design in use.

   Unless otherwise stated the measurements are made with either a Bartington *Grad601* or a Geoscan FM36 fluxgate gradiometer which incorporate two vertically aligned fluxgates, one situated either 1.0m or 0.5 metres above the other; the bottom fluxgate is carried at a height of approximately 0.2 metres above the ground surface. Both instruments incorporate a built-in data logger that records measurements digitally; these are subsequently transferred to a portable laptop computer for permanent storage and preliminary processing. Additional processing is performed on return to the Centre for Archaeology using desktop workstations.

It is the opinion of the manufacturer of the Geoscan instrument that two sensors placed 0.5 metres apart cannot produce a true estimate of vertical magnetic gradient unless the bottom sensor is far removed from the ground surface. Hence, when results are presented, the difference between the field intensity measured by the top and bottom sensors is quoted in units of nano-Tesla (nT) rather than in the units of magnetic gradient, nano-Tesla per metre (nT/m).

3) Resistivity Profiling: This technique measures the electrical resistivity of the subsurface in a similar manner to the standard resistivity mapping method outlined in note 1. However, instead of mapping changes in the near surface resistivity over an area, it produces a vertical section, illustrating how resistivity varies with increasing depth. This is possible because the resistivity meter becomes sensitive to more deeply buried anomalies as the separation between the measurement electrodes is increased. Hence, instead of using a single, fixed electrode separation as in resistivity mapping, readings are repeated over the same point with increasing separations to investigate the resistivity at greater depths. It should be noted that the relationship between electrode separation and depth sensitivity is complex so the vertical scale quoted for the section is only approximate. Furthermore, as depth of investigation increases the size of the smallest anomaly that can be resolved also increases.

Typically a line of 25 electrodes is laid out separated by 1 or 0.5 metre intervals. The resistivity of a vertical section is measured by selecting successive four electrode subsets at increasing separations and making a resistivity measurement with each. Several different schemes may be employed to determine which electrode subsets to use, of which the Wenner and Dipole-Dipole are typical examples. A Campus Geopulse earth resistance meter, with built in multiplexer, is used to make the measurements and the Campus Imager software is used to automate reading collection and construct a resistivity section from the results.

PIGGLEDENE, NORTH FARM, OVERTON, WILTS.
Location of geophysical survey, September 2008.

Figure 1

SU1369

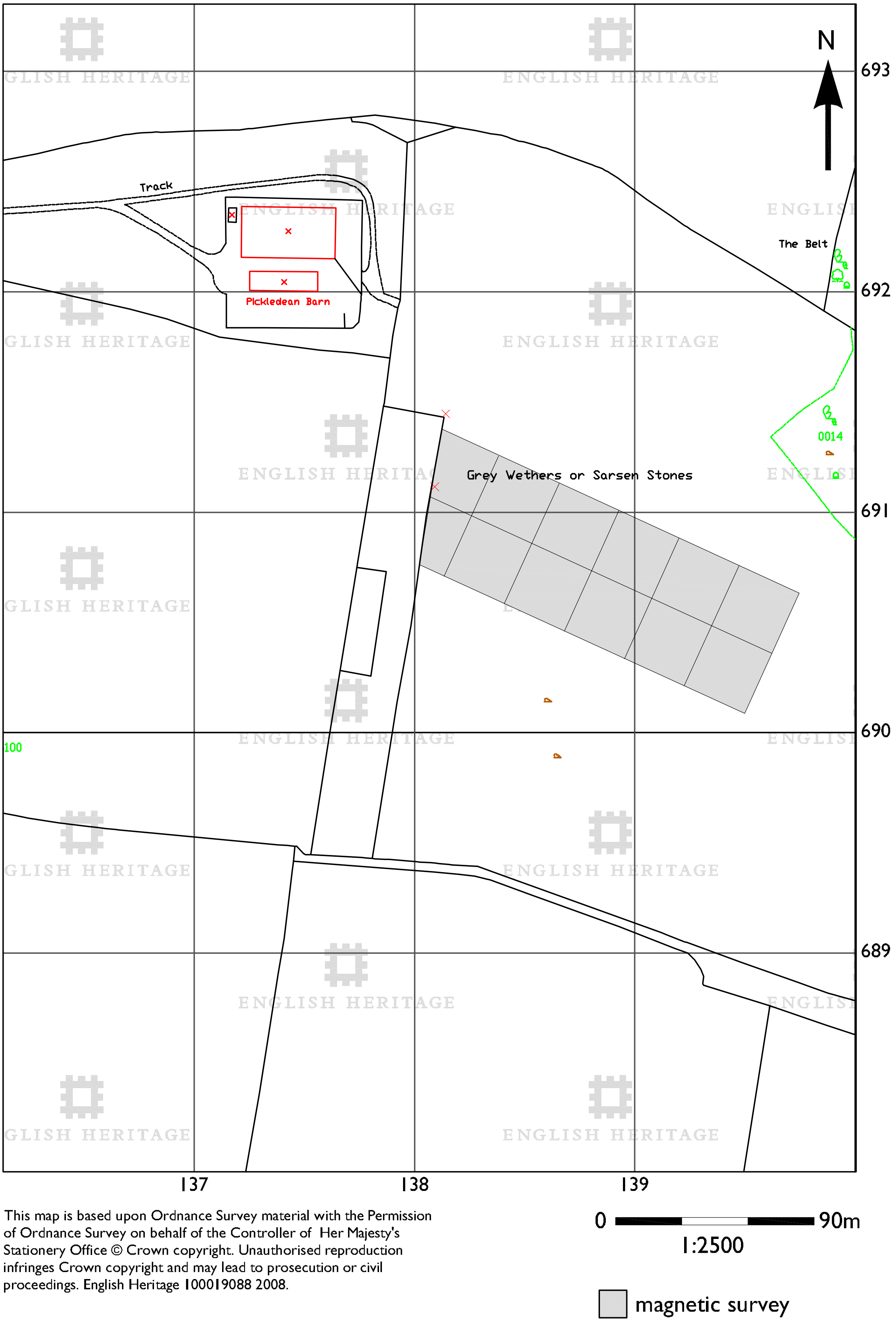

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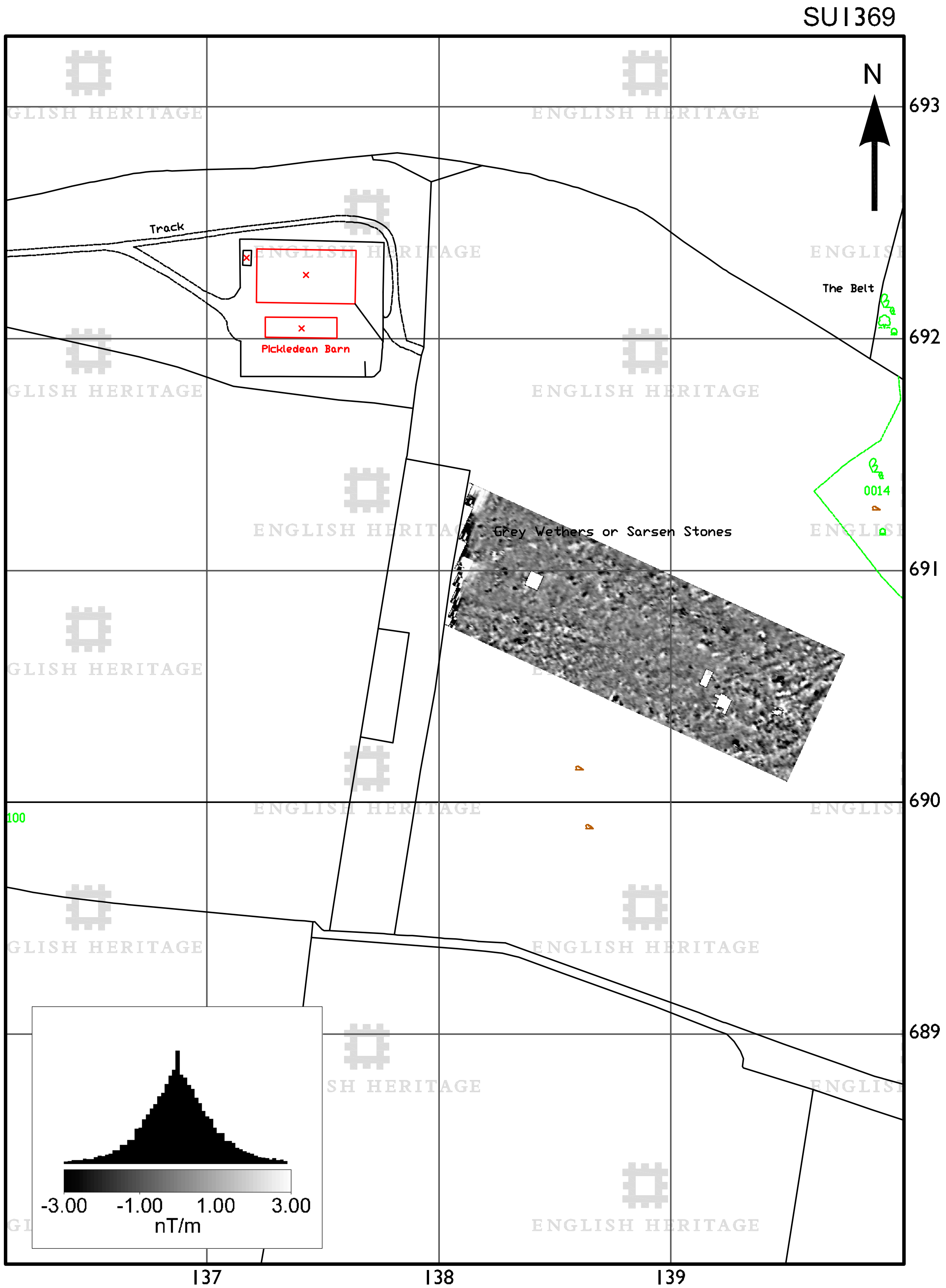
Figure 2

PIGGLEDENE, NORTH FARM, OVERTON, WILTS.

Location of geophysical survey, September 2008.



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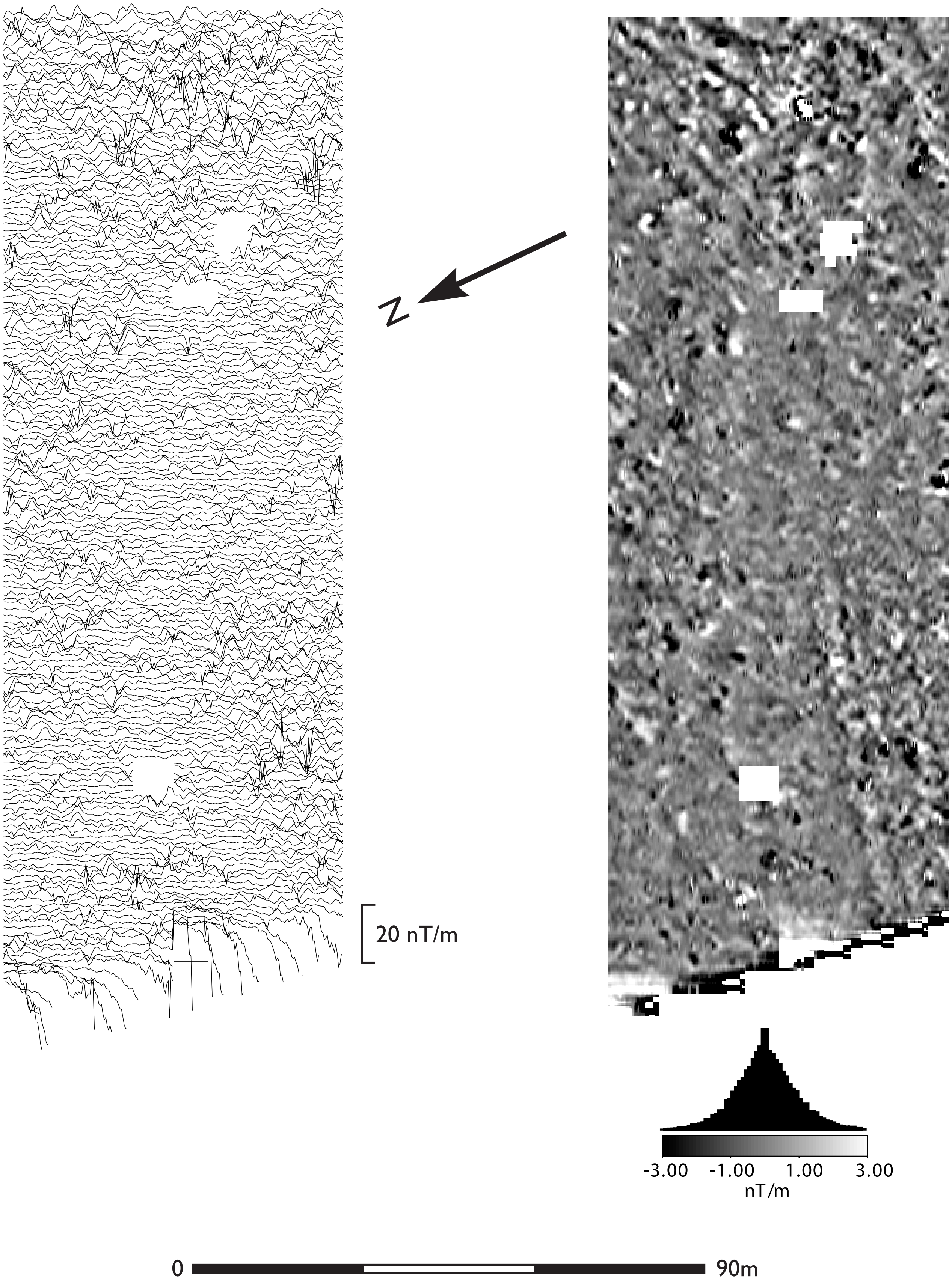
PIGGLE DOWN, NORTH FARM, WILTS.

Magnetic survey, September 2008

Figure 3

A) Traceplot of raw data

B) Linear greyscale plot of raw data



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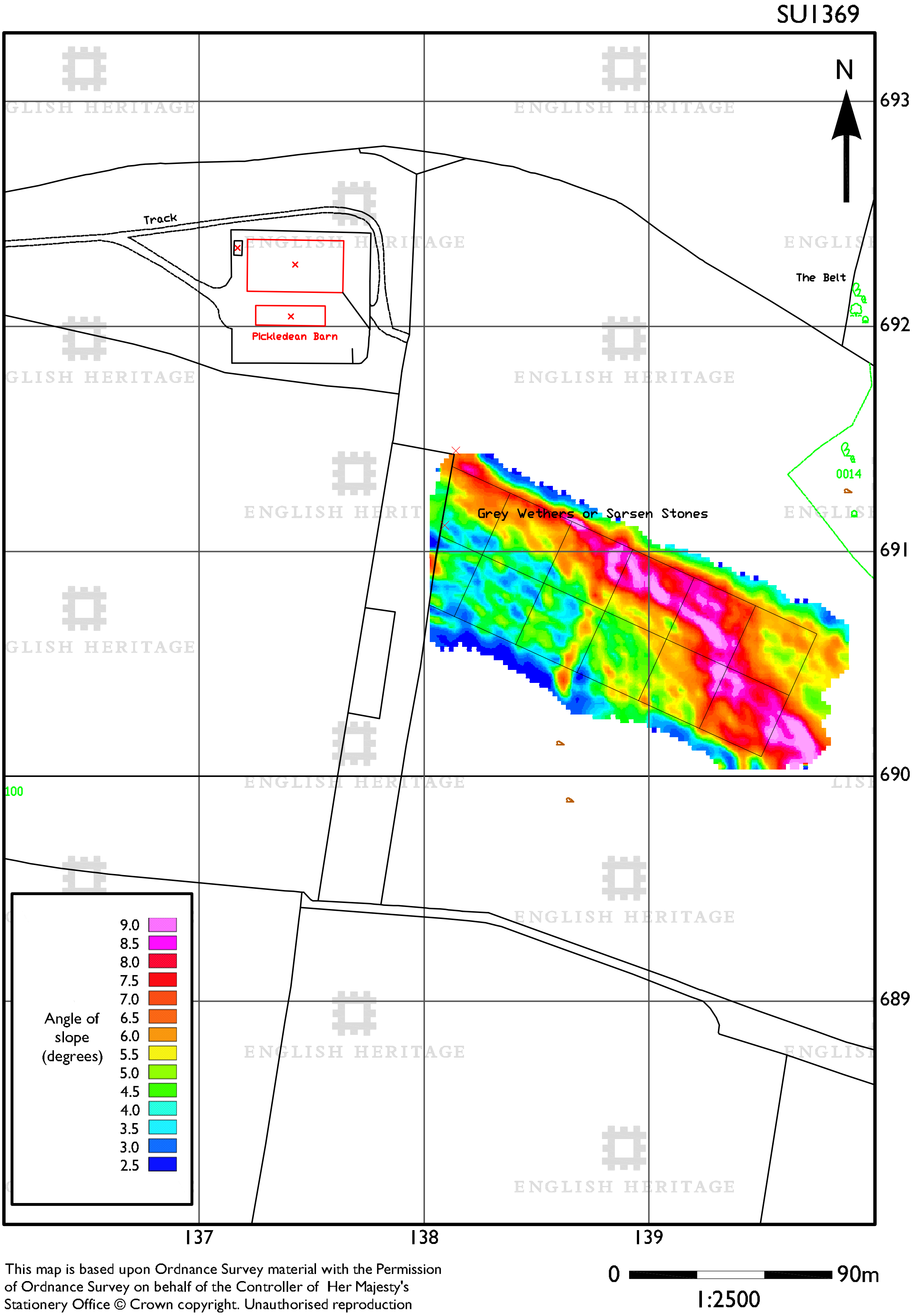
Angle of slope

Figure 4



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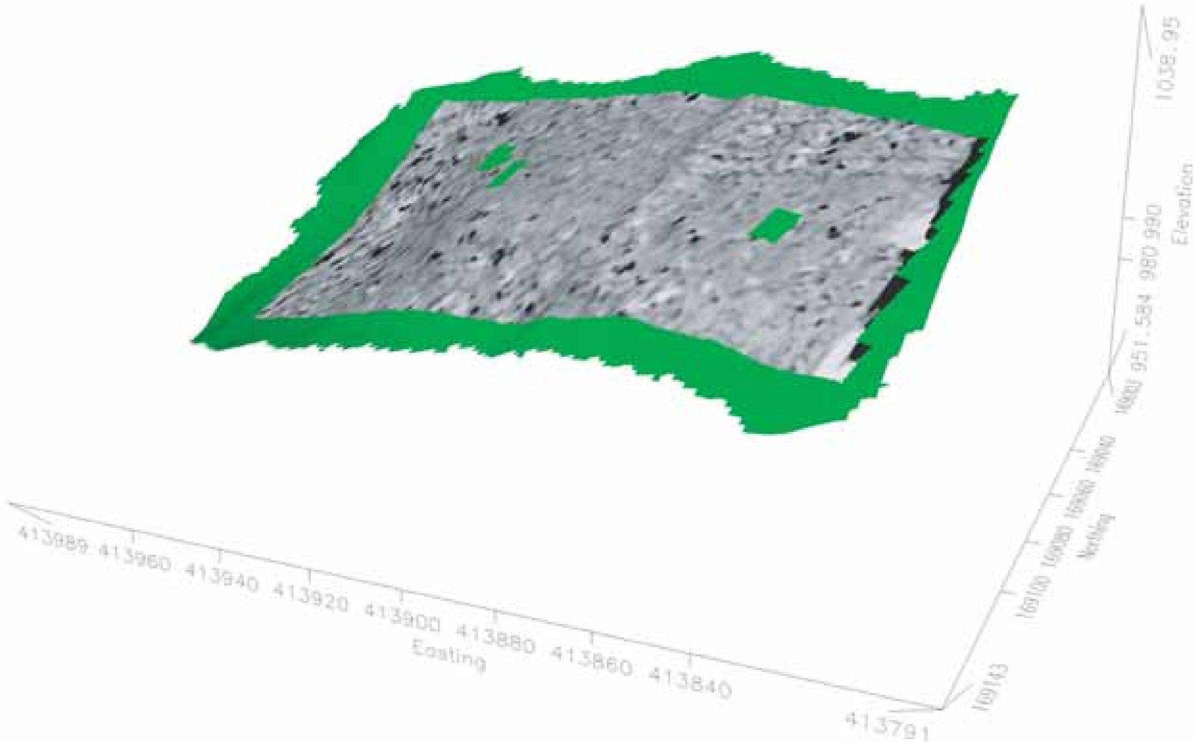
PIGGLEDENE, NORTH FARM, OVERTON, WILTS.
Magnetic survey draped over DTM

Figure 5

A) False perspective view from the NW



A) False perspective view from the E

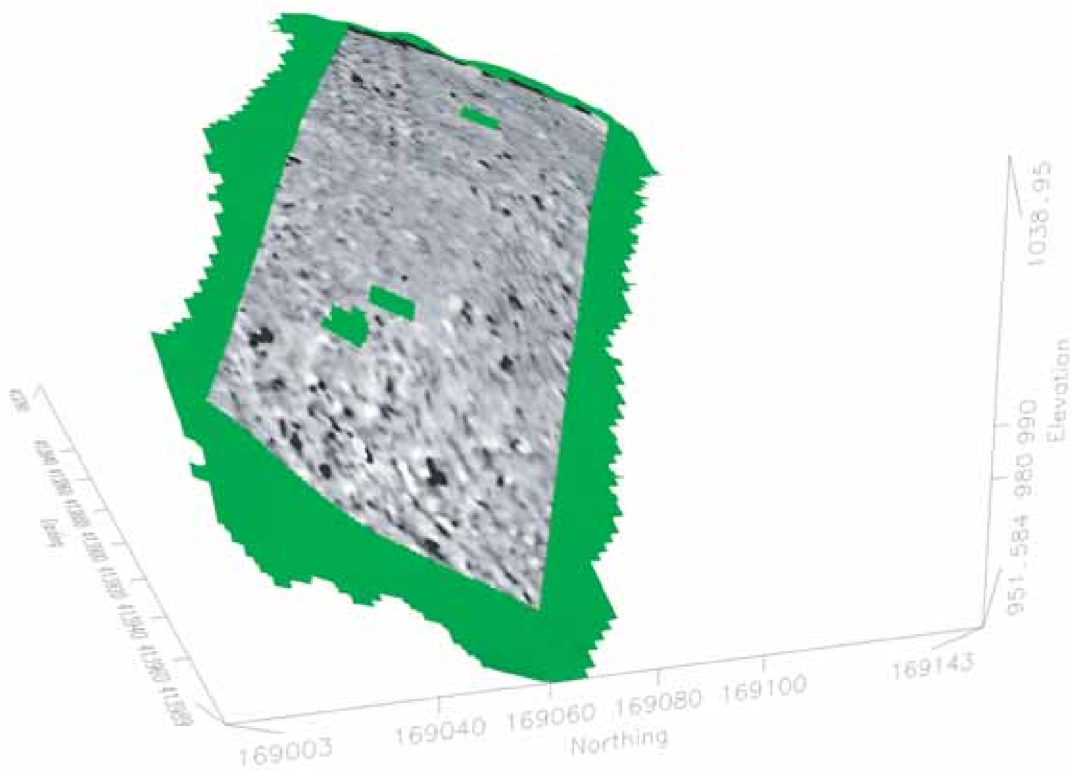


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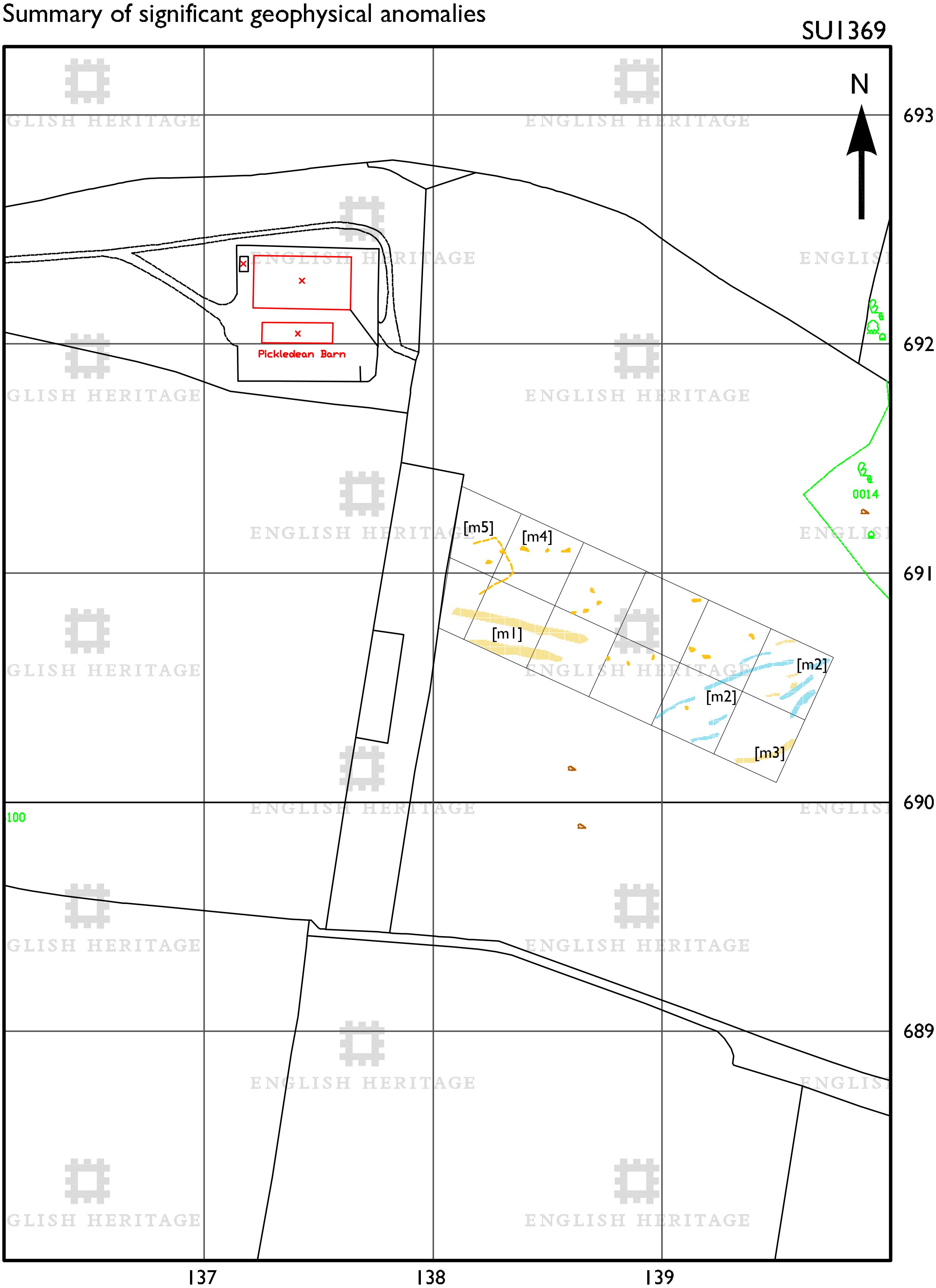
Figure 6

PIGGLEDENE, NORTH FARM, OVERTON, WILTS.

Summary of significant geophysical anomalies



0 90m

1:2500

positive discrete pit-type anomaly

positive diffuse ditch-type anomaly

highly tentative ditch-type anomaly

negative diffuse linear anomaly

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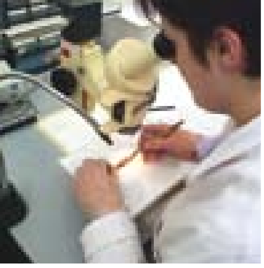
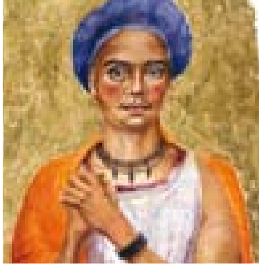



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