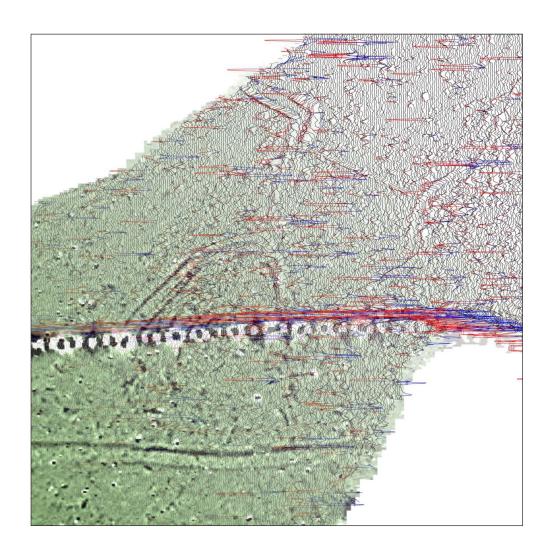


**Detailed Gradiometer Survey Report** 



Ref: 102280.01 January 2014





### **Detailed Gradiometer Survey Report**

Prepared for:

National Trust Top Road, Slindon, near Arundel, West Sussex, BN18 0RG

#### Prepared by:

Wessex Archaeology Portway House Old Sarum Park Salisbury SP4 6EB

www.wessexarch.co.uk

January 2014

Report Ref. 102280.01



#### **Quality Assurance**

Project Code	102280	Accession Code		Client Ref.	102280.01
Planning Application Ref.		Ordnance Survey (OS) national grid reference (NGR)	496000, 111075		

Version	Status*	Prepared by	Checked and Approved By	Approver's Signature	Date	
v01	I	RDL	BCU	Edil.	22/01/2014	
File:	X:\PROJECTS\102280\Geophysics\Report\102280_Geophysics_Report_RDL.Docx					
File:						
File:						
File:						
File:						

<sup>\*</sup> I = Internal Draft; E = External Draft; F = Final

#### **DISCLAIMER**

THE MATERIAL CONTAINED IN THIS REPORT WAS DESIGNED AS AN INTEGRAL PART OF A REPORT TO AN INDIVIDUAL CLIENT AND WAS PREPARED SOLELY FOR THE BENEFIT OF THAT CLIENT. THE MATERIAL CONTAINED IN THIS REPORT DOES NOT NECESSARILY STAND ON ITS OWN AND IS NOT INTENDED TO NOR SHOULD IT BE RELIED UPON BY ANY THIRD PARTY. TO THE FULLEST EXTENT PERMITTED BY LAW WESSEX ARCHAEOLOGY WILL NOT BE LIABLE BY REASON OF BREACH OF CONTRACT NEGLIGENCE OR OTHERWISE FOR ANY LOSS OR DAMAGE (WHETHER DIRECT INDIRECT OR CONSEQUENTIAL) OCCASIONED TO ANY PERSON ACTING OR OMITTING TO ACT OR REFRAINING FROM ACTING IN RELIANCE UPON THE MATERIAL CONTAINED IN THIS REPORT ARISING FROM OR CONNECTED WITH ANY ERROR OR OMISSION IN THE MATERIAL CONTAINED IN THE REPORT. LOSS OR DAMAGE AS REFERRED TO ABOVE SHALL BE DEEMED TO INCLUDE, BUT IS NOT LIMITED TO, ANY LOSS OF PROFITS OR ANTICIPATED PROFITS DAMAGE TO REPUTATION OR GOODWILL LOSS OF BUSINESS OR ANTICIPATED BUSINESS DAMAGES COSTS EXPENSES INCURRED OR PAYABLE TO ANY THIRD PARTY (IN ALL CASES WHETHER DIRECT INDIRECT OR CONSEQUENTIAL) OR ANY OTHER DIRECT INDIRECT OR CONSEQUENTIAL LOSS OR DAMAGE.



### **Detailed Gradiometer Survey Report**

#### **Contents**

Figure 6:

Figure 7:

XY trace north

Interpretation north

1.1       Project background       1         1.2       Site Location, Topography, Geology and Soils       1         1.3       Archaeological Background       2         2       METHODOLOGY       2         2.1       Introduction       2         2.2       Method       2         3       GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION       3         3.1       Introduction       3         3.2       Gradiometer Survey Results and Interpretation       3         3.3       Gradiometer Survey Results and Interpretation: Modern Services       6         4       CONCLUSION       6         5       REFERENCES       8         5.1       Bibliography       8         5.2       Cartographic Sources       8         5.3       National Trust HBSMR Records       8         5.4       West Sussex HER Records       8         APPENDIX 1:       SURVEY EQUIPMENT AND DATA PROCESSING       9         APPENDIX 2:       GEOPHYSICAL INTERPRETATION       11         Figure 3:       Site location and survey extents         Figure 2:       Greyscale south		nary					
1.1       Project background       1         1.2       Site Location, Topography, Geology and Soils       1         1.3       Archaeological Background       2         2       METHODOLOGY       2         2.1       Introduction       2         2.2       Method       2         3       GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION       3         3.1       Introduction       3         3.2       Gradiometer Survey Results and Interpretation       3         3.3       Gradiometer Survey Results and Interpretation: Modern Services       6         4       CONCLUSION       6         5       REFERENCES       8         5.1       Bibliography       8         5.2       Cartographic Sources       8         5.3       National Trust HBSMR Records       8         5.4       West Sussex HER Records       8         5.4       West Sussex HER Records       8         APPENDIX 1:       SURVEY EQUIPMENT AND DATA PROCESSING       9         APPENDIX 2:       GEOPHYSICAL INTERPRETATION       11         Figure 1:       Site location and survey extents         Figure 2:       Greyscale south	ACKITO	owieagements					
1.2       Site Location, Topography, Geology and Soils       1         1.3       Archaeological Background       2         2       METHODOLOGY       2         2.1       Introduction       2         2.2       Method       2         3       GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION       3         3.1       Introduction       3         3.2       Gradiometer Survey Results and Interpretation       3         3.3       Gradiometer Survey Results and Interpretation: Modern Services       6         4       CONCLUSION       6         5       REFERENCES       8         5.1       Bibliography       8         5.2       Cartographic Sources       8         5.3       National Trust HBSMR Records       8         5.4       West Sussex HER Records       8         APPENDIX 1:       SURVEY EQUIPMENT AND DATA PROCESSING       9         APPENDIX 2:       GEOPHYSICAL INTERPRETATION       11         Figure 3:       Site location and survey extents         Figure 2:       Greyscale south	1						
1.3       Archaeological Background       2         2       METHODOLOGY       2         2.1       Introduction       2         2.2       Method       2         3       GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION       3         3.1       Introduction       3         3.2       Gradiometer Survey Results and Interpretation       3         3.3       Gradiometer Survey Results and Interpretation: Modern Services       6         4       CONCLUSION       6         5       REFERENCES       8         5.1       Bibliography       8         5.2       Cartographic Sources       8         5.3       National Trust HBSMR Records       8         5.4       West Sussex HER Records       8         APPENDIX 1:       SURVEY EQUIPMENT AND DATA PROCESSING       9         APPENDIX 2:       GEOPHYSICAL INTERPRETATION       11         Figures         Figure 1:       Site location and survey extents         Figure 2:       Greyscale south	1.1						
2         METHODOLOGY.         2           2.1         Introduction         2           2.2         Method         2           3         GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION.         3           3.1         Introduction         3           3.2         Gradiometer Survey Results and Interpretation: Modern Services         6           4         CONCLUSION         6           5         REFERENCES         8           5.1         Bibliography         8           5.2         Cartographic Sources         8           5.3         National Trust HBSMR Records         8           5.4         West Sussex HER Records         8           APPENDIX 1:         SURVEY EQUIPMENT AND DATA PROCESSING         9           APPENDIX 2:         GEOPHYSICAL INTERPRETATION         11           Figures           Figures         Site location and survey extents           Figure 2:         Greyscale south	1.2						
2.1       Introduction       2         2.2       Method       2         3       GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION       3         3.1       Introduction       3         3.2       Gradiometer Survey Results and Interpretation: Modern Services       6         4       CONCLUSION       6         5       REFERENCES       8         5.1       Bibliography       8         5.2       Cartographic Sources       8         5.3       National Trust HBSMR Records       8         5.4       West Sussex HER Records       8         APPENDIX 1:       SURVEY EQUIPMENT AND DATA PROCESSING       9         APPENDIX 2:       GEOPHYSICAL INTERPRETATION       11         Figures       Figure 1:       Site location and survey extents         Figure 2:       Greyscale south	1.3	Archaeological Background	2				
2.2       Method       2         3       GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION       3         3.1       Introduction       3         3.2       Gradiometer Survey Results and Interpretation: Modern Services       6         4       CONCLUSION       6         5       REFERENCES       8         5.1       Bibliography       8         5.2       Cartographic Sources       8         5.3       National Trust HBSMR Records       8         5.4       West Sussex HER Records       8         APPENDIX 1:       SURVEY EQUIPMENT AND DATA PROCESSING       9         APPENDIX 2:       GEOPHYSICAL INTERPRETATION       11         Figures         Figure 1:       Site location and survey extents         Figure 2:       Greyscale south	2	METHODOLOGY	2				
3 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION	2.1	Introduction	2				
3.1 Introduction	2.2	Method	2				
3.1 Introduction	3	GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION	3				
Gradiometer Survey Results and Interpretation: Modern Services 6  CONCLUSION 6  REFERENCES 8  5.1 Bibliography 8  5.2 Cartographic Sources 8  5.3 National Trust HBSMR Records 8  5.4 West Sussex HER Records 8  APPENDIX 1: SURVEY EQUIPMENT AND DATA PROCESSING 9  APPENDIX 2: GEOPHYSICAL INTERPRETATION 11  Figures  Figure 1: Site location and survey extents  Figure 2: Greyscale south	3.1						
4 CONCLUSION	3.2						
5 REFERENCES	3.3	Gradiometer Survey Results and Interpretation: Modern Services	6				
5.1 Bibliography	4	CONCLUSION	6				
5.2 Cartographic Sources	5	REFERENCES	8				
5.3 National Trust HBSMR Records 8 5.4 West Sussex HER Records 8  APPENDIX 1: SURVEY EQUIPMENT AND DATA PROCESSING 9  APPENDIX 2: GEOPHYSICAL INTERPRETATION 11  Figures Figure 1: Site location and survey extents Figure 2: Greyscale south	5.1	Bibliography					
5.4 West Sussex HER Records	5.2	Cartographic Sources					
APPENDIX 1: SURVEY EQUIPMENT AND DATA PROCESSING	5.3						
APPENDIX 2: GEOPHYSICAL INTERPRETATION	5.4	West Sussex HER Records					
Figures Figure 1: Site location and survey extents Figure 2: Greyscale south	APPE	NDIX 1: SURVEY EQUIPMENT AND DATA PROCESSING	9				
Figure 1: Site location and survey extents Figure 2: Greyscale south	APPE	NDIX 2: GEOPHYSICAL INTERPRETATION	11				
Figure 2: Greyscale south							
		e 2: Greyscale south					
Figure 3: XY trace south							
Figure 4: Interpretation south Figure 5: Greyscale north	_	·					



### **Detailed Gradiometer Survey Report**

#### **Summary**

A detailed gradiometer survey was conducted over land off Warren Barn, near Slindon, West Sussex. The project was commissioned by the National Trust with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features on the site ahead of a proposed woodland regeneration scheme.

The site comprises an arable field around 800m south of Gumber Farm, approximately 3km north of the village of Slindon and some 7km west of Arundel. The site gently slopes from 110m OD in the northeast to 95m OD in the southwest with small dry valleys to the northwest and southeast. The site was currently under low stubble at the time of survey.

The gradiometer survey follows on from fieldwalking and excavation carried out in this field previously. The survey covered 11.7ha and has demonstrated the presence of anomalies of likely, probable and possible archaeological interest within the survey area, along with regions of increased magnetic response and one modern service.

A complex of field boundaries, tracks and enclosures has been detected along with concentrations of ceramic/metallic responses that correlate in position to the highest concentrations of Romano-British ceramic building material identified through fieldwalking. The barrow cemetery recorded in this field failed to show in the data; it is unclear why this might be the case.

A modern service was detected within the Site, predominantly oriented east-west across the centre of the survey area. This feature has likely impacted on the archaeology it runs through as well as obscuring other archaeological features close by.

The geophysical survey has demonstrated a high archaeological potential across the Site with the southern half of the site in particular containing a dense concentration of tracks and enclosure ditches. The site may benefit from further geophysical survey such as ground penetrating radar or earth resistance to assess whether foundations from stone buildings are present and whether ring ditches exist where gradiometer survey seemed to fail to detect them.



### **Detailed Gradiometer Survey Report**

#### **Acknowledgements**

The detailed gradiometer survey was commissioned by the National Trust. The assistance of Tom Dommett is gratefully acknowledged in this regard.

The fieldwork was undertaken by Clara Dickinson, Jen Smith and Rachel Chester. Ben Urmston and Ross Lefort processed the geophysical data which was interpreted by Ross Lefort who also wrote this report. The geophysical work was quality controlled by Ben Urmston. Illustrations were prepared by Kenneth Lymer. The project was managed on behalf of Wessex Archaeology by Ben Urmston.



### **Detailed Gradiometer Survey Report**

#### 1 INTRODUCTION

#### 1.1 Project background

- 1.1.1 Wessex Archaeology was commissioned by the National Trust to carry out a geophysical survey of land off Warren Barn, within the Slindon Estate, West Sussex (**Figure 1**), hereafter "the Site" (centred on NGR 496000 111075). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of proposed woodland restoration at the Site.
- 1.1.2 The geophysical survey was commissioned to fulfil the following aims set out in the brief for the geophysical survey (National Trust 2013):
- "The purpose of the survey is to identify and determine the nature and extent of archaeological features within the study area (War Ag 2) in order to inform woodland restoration proposals. It will consist of geophysical (fluxgate gradiometer) survey over 12.2ha."
- "It will provide up-to-date archaeological and historical information in both report and digital HBSMR form that can be drawn on for interpretation and educational use."
- "The survey will take account of the prehistory of the landscape and of any evidence relating to Roman or Saxon settlement and exploitation. It will also assess the evidence relating to medieval and post-medieval settlement and land use, including parkland and designed landscape features and the twentieth-century landscape changes and military use of the landscape."
- "It will identify current or potential management issues and give recommendations for further work and mitigation of damage to the archaeology resulting from proposed woodland restoration."
- 1.1.3 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

#### 1.2 Site Location, Topography, Geology and Soils

- 1.2.1 The survey area comprises an arable stubble field (War Ag 2) off Warren Barn, some 3km north of the centre of Slindon (**Figure 1**). Detailed gradiometer survey was undertaken over all accessible parts of the Site, a total of 11.7 ha.
- 1.2.2 The Site occupies a spur of land gently sloping land from 100m OD in the northeast to 95m OD in the Southeast, with small dry valleys to the northwest and southeast. The survey area is defined to the north and west by a narrow strip of woodland, with a bridleway running along its westernmost edge. The southern boundary is defined by an area of woodland followed by a wire fence line.



- 1.2.3 The solid geology is recorded as Newhaven Chalk Member (Cretaceous) towards the south of the Site and Seaford Chalk Member (Cretaceous) to the north. The superficial deposits recorded are head deposits (Quaternary) along the northwest edge of the survey area (Allen 2012).
- 1.2.4 The soils underlying the Site are likely to be brown rendzinas of the 343i (Andover 2) association (SSEW 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

#### 1.3 Archaeological Background

- 1.3.1 A number of archaeological assessments have been carried out prior to this survey (Whitfield 1994, Ede 1995 and Southern Archaeology 1997). This previous work should be consulted for a fuller assessment of the archaeological background. The main heritage assets of interest within this field are a Bronze Age barrow cemetery (10 barrows) and a concentration of Romano British material thought to relate to a villa or farmstead. Three barrows were recorded as extant in the HER data but more recent records held by the National Trust state that only one barrow is now extant suggesting erosion/plough damage may have taken place (MWS2572, MWS2573, MWS2574, MWS6939 and HBSMR121030). In addition to the Romano-British settlement and barrow cemetery an ancient field system is recorded close by with a couple of features extending into this field (MWS2540).
- 1.3.2 Fieldwalking in the area and excavation of one of the barrow ditches has been undertaken by the Worthing Archaeological Society in 2001. Fieldwalking was also carried out by Southampton University in conjunction with James Kenny (National Trust 2013). The HER records also state that a trial excavation was carried out by James Kenny in this field that revealed linear cuts/gullies, Romano-British pottery and a flint wall footing (MWS6356). The HER records state that over 3700 sherds of Roman pottery have been recovered including roof tile and brick fragments along with glass, iron objects and quernstones (MWS6940). Surface finds of Bronze Age pottery, flints, burnt bone and a carbonised pea have been recovered from the barrow cemetery area (MWS2574).

#### 2 METHODOLOGY

#### 2.1 Introduction

- 2.1.1 The detailed magnetometer survey was conducted using a Bartington Grad601-2 dual fluxgate gradiometer system. The survey was conducted in accordance with English Heritage guidelines (2008).
- 2.1.2 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team between the 25<sup>th</sup> and the 28<sup>th</sup> November 2013. Field conditions at the time of the survey were good, with the survey area having been drilled and rolled immediately prior to the survey.

#### 2.2 Method

- 2.2.1 Individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (2008).
- 2.2.2 The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data



- were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with EH guidelines (2008). Data were collected in the zigzag method.
- 2.2.3 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse function (±5nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey areas, with no interpolation applied.
- 2.2.4 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 1**.

#### 3 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION

#### 3.1 Introduction

- 3.1.1 The gradiometer survey has been successful in identifying anomalies of likely, probable and possible archaeological interest across the Site, along with a modern service. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1250 (**Figures 2** to **7**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots.
- 3.1.2 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (**Figures 4** and **7**). Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.
- 3.1.3 The archaeology category is divided into two sub-categories based on the strength of the magnetic values of the observed anomalies. Archaeology is used to categorise clear archaeological anomalies with values over +2nT and Archaeology (weak response) is used to classify clear archaeological anomalies with values under +2nT. This division was felt necessary to highlight that there are clear differences in the strength of the fills of many of the ditch segments observed throughout this data set.
- 3.1.4 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

#### 3.2 Gradiometer Survey Results and Interpretation

- 3.2.1 There are a number of ditch segments running through the data that appear to form an early field system. Many of these divisions are defined by parallel double ditches such as at **4000** where there are two ditches aligned east-west separated by a distance of 5m to 6m. There is a break in the ditches at **4001** and this gap is occupied by a broad area of weaker positive values, and therefore may represent an entrance. This linear feature has been classed as archaeology with much weaker areas defined by trends and possible archaeology.
- 3.2.2 A complex of at least four small enclosed areas extends from the northern side of this boundary with curving trends and clearer ditch segments defining their extents at **4002**, **4003**, **4005** and **4007-4012**. The largest of these enclosures around **4007** is subrectangular in shape and measures approximately 80m x 70m; the northern and western sides of this enclosure are defined by a double ditch. Aside from a few small pit-like anomalies and short ditch-like anomalies there is little apparent in the gradiometer data to suggest the presence of extensive internal features. A spread of increased magnetic



response around **4029** may indicate a concentration of anthropogenic debris in this part of the enclosure.

- 3.2.3 This enclosure is interrupted by an east-west aligned modern service at **4006**; this has partially obscured some internal features and may have impacted on others. The ditch segments have been interpreted as archaeology although some very weak regions have been defined by trends, as at **4002**. The small internal features have been defined as archaeology, probable and possible archaeology depending on the strength and regularity of these features.
- 3.2.4 A second enclosure is apparent to the east at **4004**; this is sub-rectangular measuring at least 50m in length and approximately 22m in width. There is a break in the ditch surrounding this enclosure to the south of **4005** that may prove to be an entrance. Unlike the previous enclosure there does appear to be some internal division with a much smaller enclosure connected via a single ditch to the boundary ditch of this enclosure. The smallest enclosure measures 5.5m x 4m with a possible entrance in the northeast corner; its purpose is unclear and the presence of the service to the north obscuring this part of the field makes the interpretation less certain. The features discussed above have been classed as archaeology although the western side of the enclosure is partially defined by a trend.
- 3.2.5 A triangular enclosure lies to the north with double ditches defining the south and west sides at **4008** and **4009** with a single ditch defining the northern side at **4010**. The enclosure measures approximately 55m in length and 25m in width at the widest point. There are few features visible inside this enclosure apart from some very small pit-like anomalies. The boundary ditches have been classed as archaeology and the small pit-like anomalies within have been classed as possible archaeology.
- 3.2.6 The fourth enclosure lies to the north of the triangular one and is sub-trapezoidal in shape, defined by single ditches at **4010**, **4011** and **4012** and a curving double ditch at **4015**. The enclosure measures around 65m in length, 50m in width at its widest point and tapers to around 20m wide at the narrow end. Several pit-like anomalies are visible within the enclosure around **4013** along with a short curving ditch segment just north of **4013**. The enclosure ditches have been interpreted as archaeology and the smaller internal features have been interpreted either as probable archaeology or possible archaeology depending on their strength, size and form.
- 3.2.7 There are several breaks in the ditches making up this enclosure some of which may represent entrances. A break in the northwest corner links to an L-shaped corridor at **4014** that is defined by a pair of parallel ditch-like anomalies. The ditch segments here have some fairly strong magnetic values that are over +4nT in places. These parallel double ditches have been seen around other enclosures and run through much of the survey area; they are typically spaced between 4m and 8m apart and seem to link the enclosures together. The purpose of these double ditches appears to be to define some form of track or droveway as well as to define enclosures and field boundaries. Most of these ditch segments are defined as archaeology but the extremely weak areas, less than +0.5nT, are defined as trends.
- 3.2.8 The curving double ditch at **4015** does not appear to curve around to form a complete enclosure to its east but a weak trend at **4016**, on the line of the curving ditch, suggests the ditch may fade out rather than terminate suddenly. This fading may be a reflection of poor preservation due to plough damage but could also simply be a loss of magnetic contrast due to the fill of the ditches becoming fairly sterile as they extend away from a settlement area. There are two isolated regular looking anomalies to the east of this



- double ditch; one is located to the northeast of **4015** and is C-shaped and the other is located to the northeast of **4016** and is L-shaped. The double ditches are defined as archaeology and the two isolated anomalies discussed above are defined as archaeology and probable archaeology.
- 3.2.9 In addition to the regular shaped positive anomalies, the area to the east of **4015** contains two large spreads of increased magnetic response. These spreads are defined by a concentration of bipolar and dipolar anomalies (small black and white anomalies in the greyscale) and are likely to be caused by concentrations of ceramic and/or metallic debris resulting from human occupation or activity. This debris possibly relates to the known Romano-British settlement in this field.
- 3.2.10 The curved double ditch straightens out slightly as it runs further north at **4017**, **4019** and **4021**; the magnetic values fade out in places as it runs to the far north of the survey area. There are also single and double ditches extending perpendicular from this main track to the east and west at **4018**, **4020** and **4022**. Most of these ditches have positive values although **4022** is unusual in that it appears as a clear negative anomaly with values around -1.5nT. These ditches look more like they are defining larger fields rather than settlement enclosures; all have been classed as archaeology as they fit with the pattern of Iron Age and Romano-British field systems observed nearby (Whitfield 1994).
- 3.2.11 The boundary at **4018** has a peculiar sub-rectangular region of positive magnetic values at its eastern end. The function of this feature is unclear but it is believed to be a cut feature. At the western end of this boundary around **4017** are two small sub-triangular enclosures; both measure around 25m in length with a maximum width of 14m for the northern one and 9m for the southern one. These enclosures seem too small to form settlement enclosures and the smaller southern one appears to be sub-divided which may suggest they served an agricultural function. All of these features have been classed as archaeology.
- 3.2.12 Further away from the system of ditches discussed above are a number of isolated anomalies. These include a clear pit at **4023** with magnetic values over +3nT and a length of 3.2m, a less well defined pit-like anomaly at **4024**, and a linear ditch segment at **4025**. These features are classed as either archaeology or probable archaeology depending on their regularity in plan.
- 3.2.13 There are numerous weak trends running through the data, some have been encountered above as they are used to define weak segments of enclosure ditches such as at **4002** and **4016**. There are others such as around **4026** where regular patterns are formed by them that cannot be explained as ploughing trends. There are also other parallel trends such as those around **4027** that may show evidence of earlier agricultural use of this land. Some of these trends may prove to be of archaeological interest but their weak values (less than +0.5nT) prohibit a more confident interpretation being applied to them.
- 3.2.14 There are several spreads of increased magnetic response scattered across the data; all appear to be defined by concentrations of magnetic debris such as ceramic and/or metallic material. What is less clear is the date of these concentrations of material; spreads such as around **4028** may prove to be modern given their location along the field boundary but others such as the two spreads east of **4015** and the one around **4029** may prove to be of greater archaeological interest.
- 3.2.15 The remaining features are either modern ploughing scars or a scatter of small sub-oval and sub-circular positive anomalies spread across the whole field. Some of these positive anomalies may prove to be isolated archaeological features such as small pits and



postholes but others may prove to be natural features such as tree throws. These anomalies have been classed as possible archaeology as there is no significant patterning in their spatial distribution to suggest they are of any greater archaeological significance.

#### 3.3 Gradiometer Survey Results and Interpretation: Modern Services

- 3.3.1 There is one modern service present at **4006** that appears to be a pipe made up of segments made of ferrous material. It passes through the survey area on a roughly eastwest alignment straight through the archaeological enclosures in the centre of the field.
- 3.3.2 It is not clear from the geophysical data whether the service identified is in active use. It should also be noted that gradiometer survey may not detect all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.

#### 4 CONCLUSION

- 4.1.1 The detailed gradiometer survey has been successful in detecting anomalies of likely, probable and possible archaeological interest within the Site, in addition to regions of increased magnetic response and one modern service. The absence of any identifiable anomalies associated with barrows is notable, as ten are recorded in this field.
- 4.1.2 The most obvious features observed in the data are a series of ditches defining enclosures, possibly related to settlement, and field boundaries. Many of these boundaries are double ditched and these are considered to define tracks or droveways. The orientation and layout of these boundaries suggests they form part of the ancient field system recorded by the HER and Whitfield (1994).
- 4.1.3 The fieldwalking results from Southampton University show a correlation between the areas defined as increased magnetic responses in the geophysical data and the areas with the highest concentration with Romano-British Ceramic Building Material (CBM). These concentrations also lie very close to the four adjoining enclosures identified in the geophysical data suggesting these ditches define the settlement areas and areas of specialised agricultural or industrial activity within the settlement complex.
- 4.1.4 No building foundations have been identified from this data. The reason for this may stem from the materials used in their construction; if flint or chalk was used then the walls would not exhibit any measureable magnetic contrast and would therefore not be visible in the data. Gradiometer survey is not suited to the detection of walls in sedimentary geology unless ceramic bricks are used in construction. To find such remains another geophysical technique such as Ground Penetrating Radar (GPR) or earth resistance survey would need to be employed.
- 4.1.5 The survey results are notable in that no anomalies were identified that can be confidently linked with a ring ditch of a barrow. The closest thing to a partial ring ditch would be a short curvilinear anomaly north of **4013** but this does not look regular enough in shape for what would be expected from a barrow ditch. The explanation for the lack of any barrows in the data is unclear; if it were a simple case of plough damage then the field system and enclosures detected might be difficult to see. Other possible explanations for the inability to detect the barrows might stem from them having magnetically sterile ditch fills or that the barrows were constructed without the creation of a deep quarry ditch; both cases might create a feature that is difficult to detect through gradiometer survey. Trialling another geophysical technique such as GPR or earth resistance might help to determine



- whether any ring ditches are present as these techniques measure and respond to different soil properties from gradiometer survey such as moisture content.
- 4.1.6 The gradiometer survey has successfully identified potential areas of settlement activity within this field. This is beneficial as a smaller region towards the south could now be targeted more precisely with other techniques such as GPR, earth resistance or through excavation.
- 4.1.7 The relative dimensions of the modern services identified by the gradiometer survey are indicative of the strength of their magnetic response, which is dependent upon the materials used in their construction and the backfill of the service trenches. The physical dimensions of the services indicated may therefore differ from their magnetic extents in plan; it is assumed that the centreline of services is coincident with the centreline of their anomalies, however. Similarly, it is difficult to estimate the depth of burial of the services through gradiometer survey.
- 4.1.8 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey.



#### 5 REFERENCES

#### 5.1 Bibliography

Allen, R. 2012. Land at Courthill Farm, Slindon Estate, West Sussex: Soil Appraisal, Capability and Guidance for Land Management (Unpublished Report).

Ede, J. 1995. Land Use History and Landscape Development of the Slindon Estate, West Sussex (Unpublished Report).

English Heritage 2008. Geophysical Survey in Archaeological Field Evaluation. Research and Professional Service Guideline No 1, 2nd edition.

National Trust 2013. War AG 2, Courthill Farm, Slindon, West Sussex: Brief for Geophysical Survey of 'War AG 2 Barrow Cemetery & Romano-British Settlement (Unpublished Report).

Southern Archaeology 1997. The Upton Collection of Archaeological Artefacts from the National Trust Slindon Estate, West Sussex (Unpublished Report).

Whitfield, C. 1994. The Slindon Estate Historical Landscape Survey (Unpublished Report).

#### 5.2 Cartographic Sources

Soil Survey of England and Wales 1983. *Sheet 6, South East England.* Ordnance Survey, Southampton.

#### 5.3 National Trust HBSMR Records

HBSMR121030 - Bronze Age barrow cemetery

#### 5.4 West Sussex HER Records

MWS2540 – Ancient field system

MWS2572 - Bronze Age barrow cemetery

MWS2573 – Bronze Age barrow cemetery

MWS2574 – Bronze Age barrow cemetery

MWS6356 - Trial excavation

MWS6939 - Bronze Age barrow cemetery

MWS6940 - Romano-British settlement



#### APPENDIX 1: SURVEY EQUIPMENT AND DATA PROCESSING

#### Survey Methods and Equipment

The magnetic data for this project was acquired using a Bartington 601-2 dual magnetic gradiometer system. This instrument has two sensor assemblies fixed horizontally 1m apart allowing two traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1m separation, and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.

The gradiometers have an effective resolution of 0.03nT over a ±100nT range, and measurements from each sensor are logged at intervals of 0.25m. All of the data are stored on an integrated data logger for subsequent post-processing and analysis.

Wessex Archaeology undertakes two types of magnetic surveys: scanning and detail. Both types depend upon the establishment of an accurate 20m or 30m site grid, which is achieved using a Leica Viva RTK GNSS instrument and then extended using tapes. The Leica Viva system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined with a precision of 0.02m in real-time and therefore exceed the level of accuracy recommended by English Heritage (2008) for geophysical surveys.

Scanning surveys consist of recording data at 0.25m intervals along transects spaced 10m apart, acquiring a minimum of 80 data points per transect. Due to the relatively coarse transect interval, scanning surveys should only be expected to detect extended regions of archaeological anomalies, when there is a greater likelihood of distinguishing such responses from the background magnetic field.

The detailed surveys consist of 20m x 20m or 30m x 30m grids, and data are collected at 0.25m intervals along traverses spaced 1m apart. These strategies give 1600 or 3600 measurements per 20m or 30m grid respectively, and are the recommended methodologies for archaeological surveys of this type (EH, 2008).

Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.125m intervals along traverses spaced up to 0.25m apart, resulting in a maximum of 28800 readings per 30m grid, exceeding that recommended by English Heritage (2008) for characterisation surveys.



#### Post-Processing

The magnetic data collected during the detail survey are downloaded from the Bartington system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the GPS information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.

Typical data and image processing steps may include:

- Destripe Applying a zero mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;
- Destagger Shifting each traverse longitudinally by a number of readings. This corrects for operator errors and is used to enhance linear features;
- Despike Filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data)

Typical displays of the data used during processing and analysis:

- XY Plot Presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This type of image is useful as it shows the full range of individual anomalies.
- Greyscale Presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.



#### APPENDIX 2: GEOPHYSICAL INTERPRETATION

The interpretation methodology used by Wessex Archaeology separates the anomalies into two main categories: archaeological and unidentified responses.

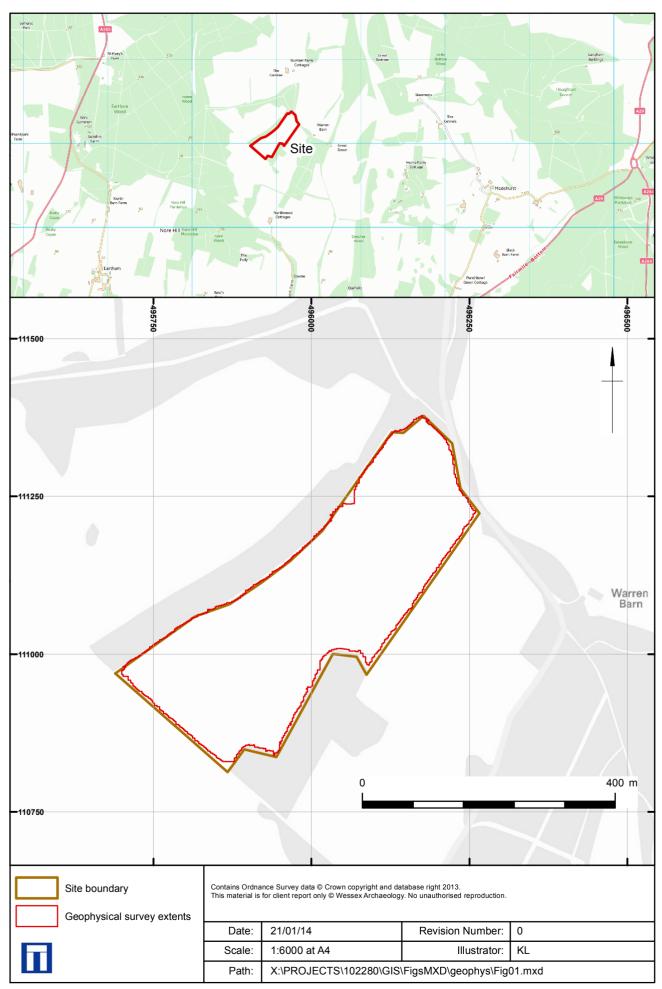
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further subdivided into three groups, implying a decreasing level of confidence:

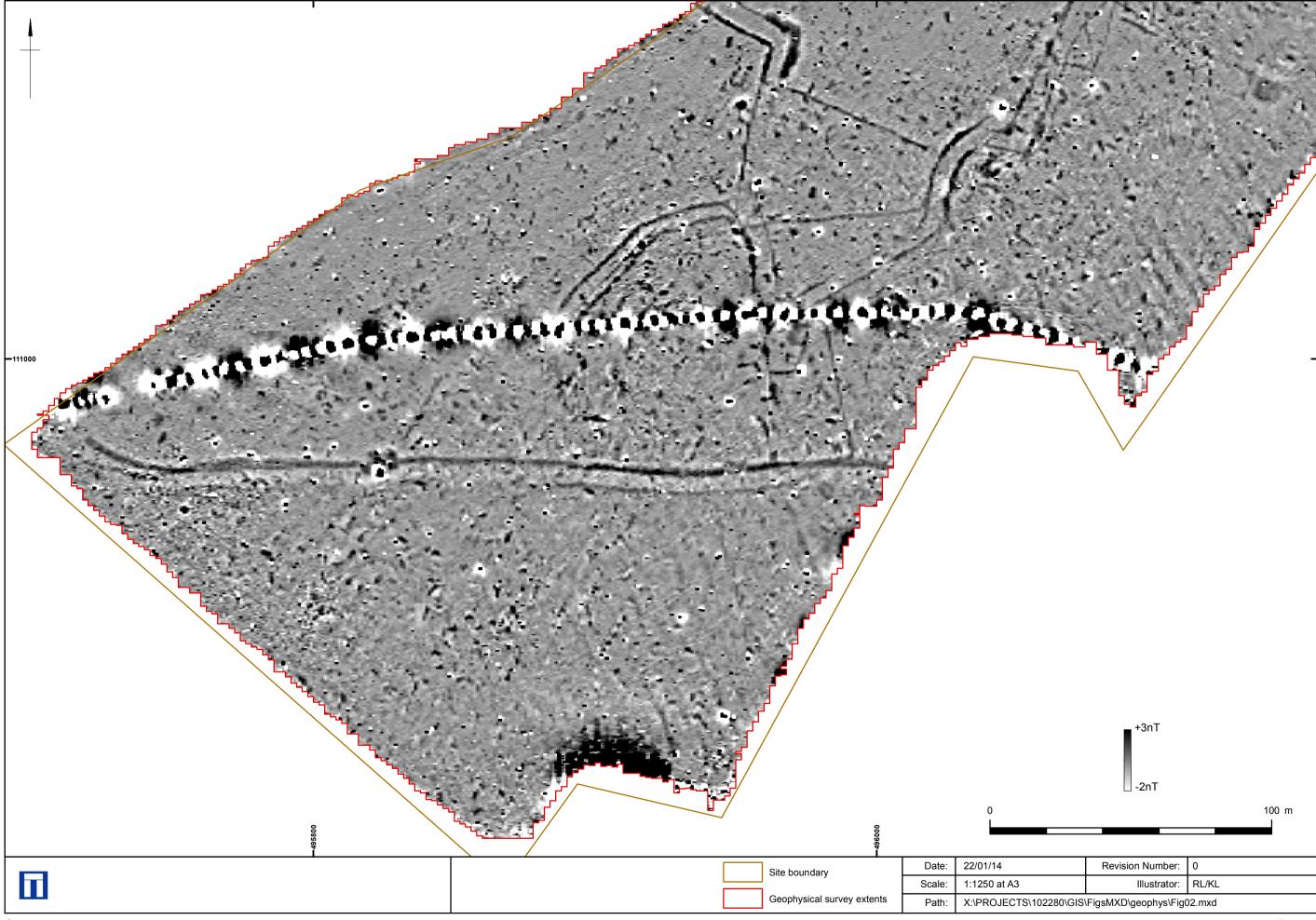
- Archaeology used when there is a clear geophysical response and anthropogenic pattern.
- Archaeology (weak response) used when there is a clear geophysical response and anthropogenic pattern but measured magnetic values are much lower.
- Probable archaeology used for features which give a clear response but which form incomplete patterns.
- Possible archaeology used for features which give a response but which form no discernible pattern or trend.

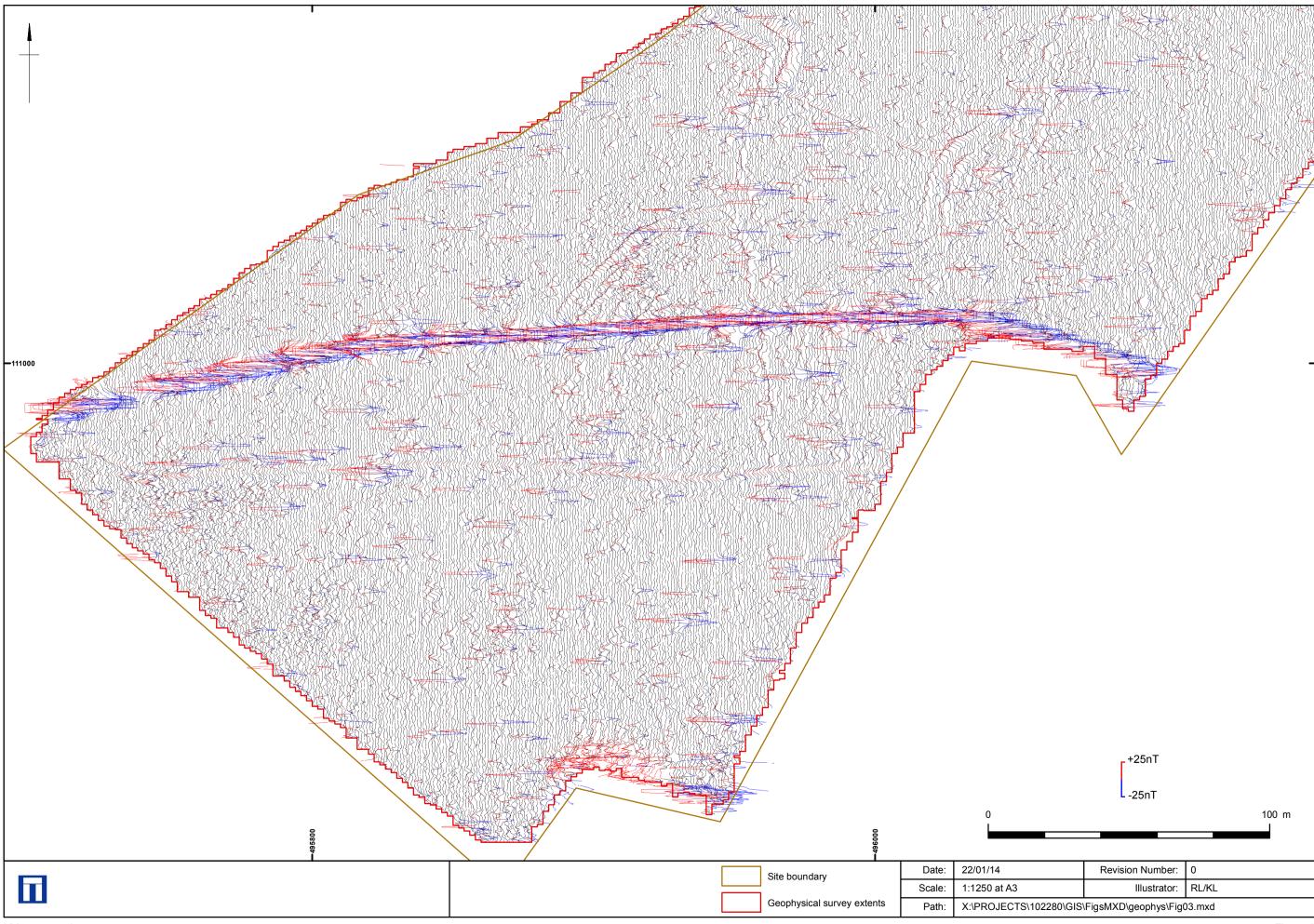
The unidentified category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

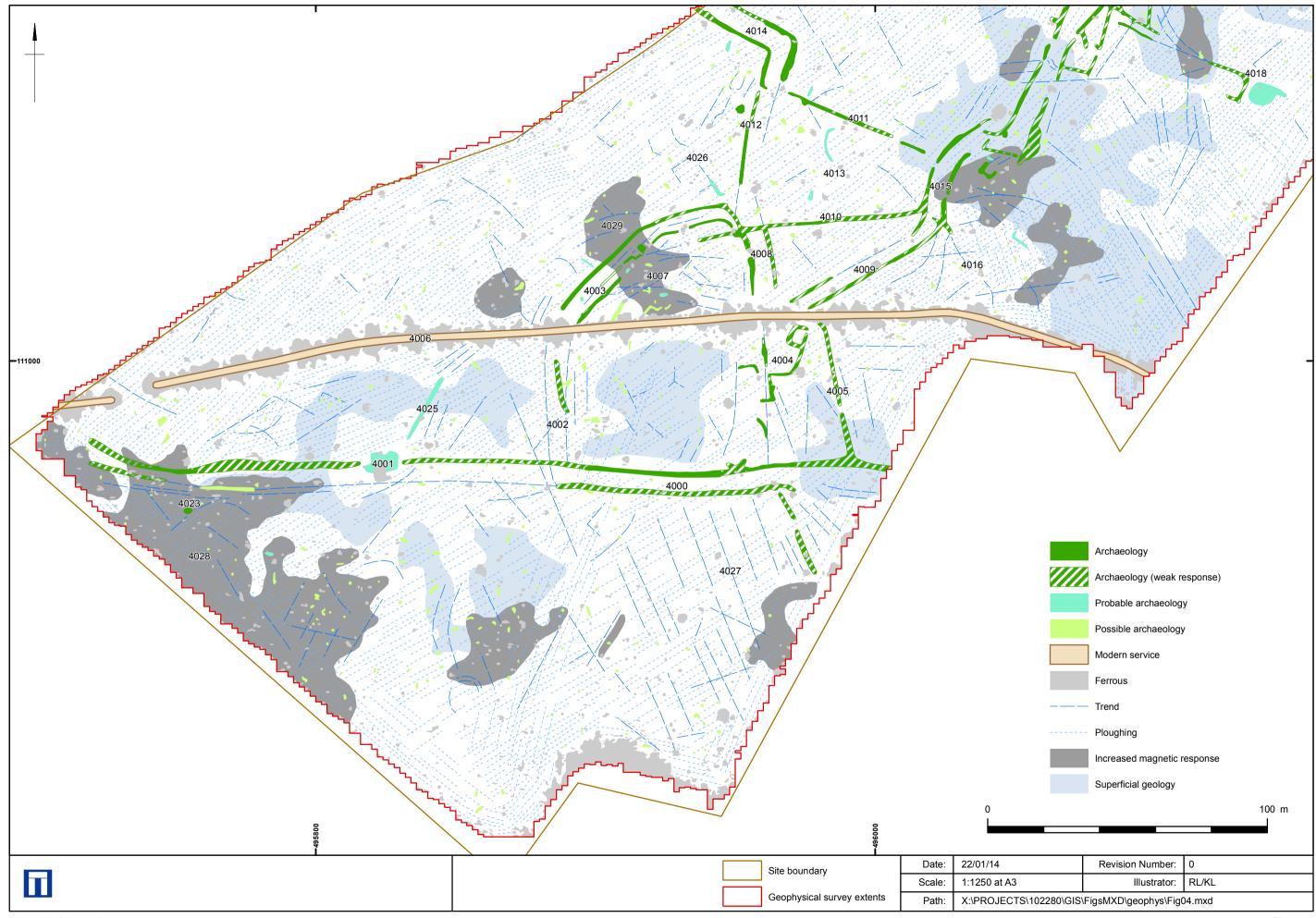
- Increased magnetic response used for areas dominated by indistinct anomalies which may have some archaeological potential.
- Trend used for low amplitude or indistinct linear anomalies.
- Ferrous used for responses caused by ferrous material. These anomalies are likely to be of modern origin.

Finally, services such as water pipes are marked where they have been identified.









Interpretation south



