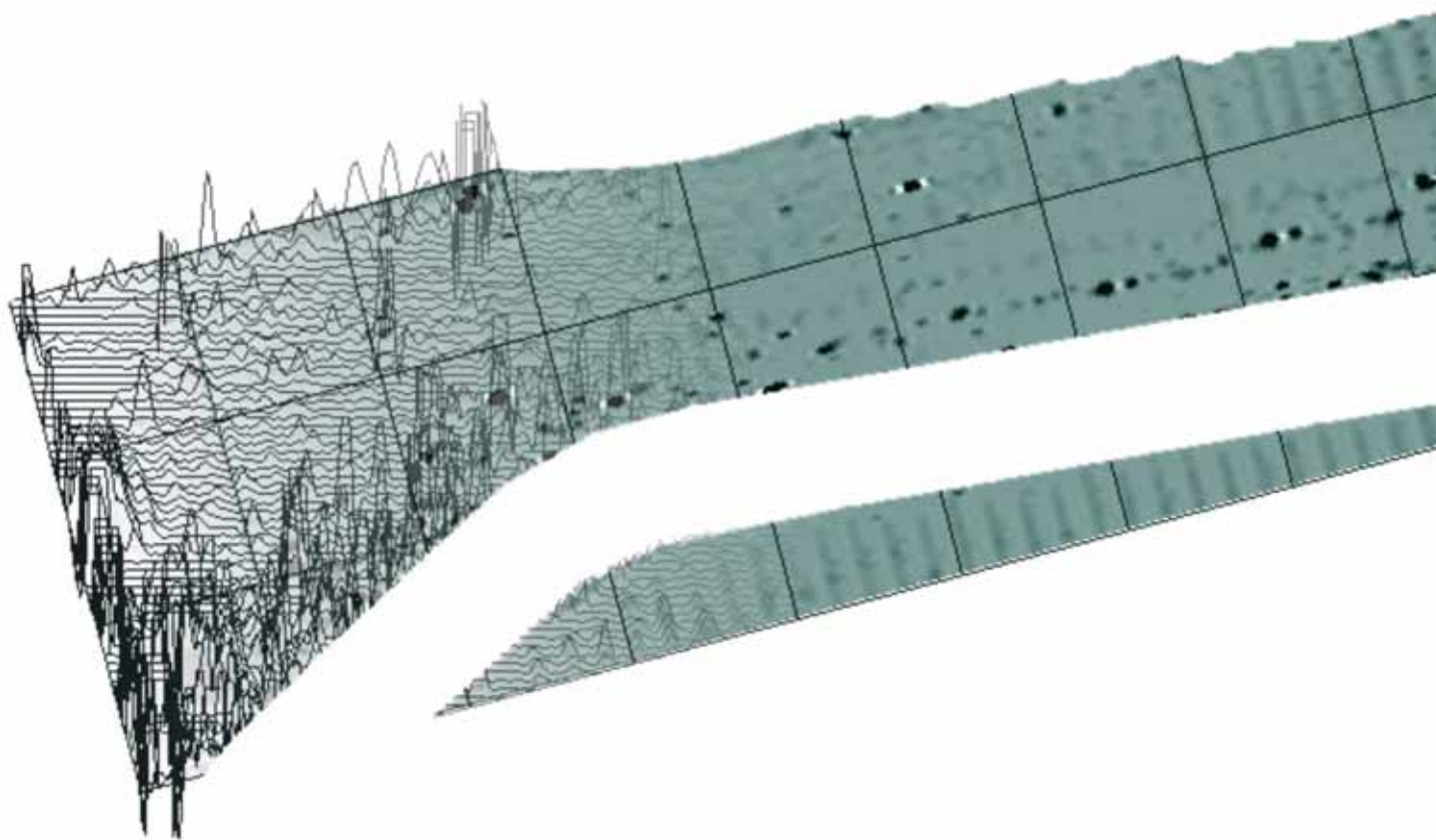




Watchkeeper UAV
Upavon Airfield, Wiltshire

Archaeological Evaluation
of Geophysical Data



**WATCHKEEPER UAV
UPAVON AIRFIELD, WILTSHIRE**

Detailed Gradiometer Survey

Final Technical Report

Prepared for:

Enviros Consulting Ltd
Enviros House
Shrewsbury Business Park
Shrewsbury
Shropshire
SY2 6LG

By:

Wessex Archaeology
Portway House
Old Sarum Park
Salisbury
SP4 6EB

Ref: 66373.01

December 2007

WATCHKEEPER UAV
UPAVON AIRFIELD, WILTSHIRE

Detailed Gradiometer Survey

Ref. 66373.01

Technical Summary

Wessex Archaeology was commissioned by Enviros Consulting Ltd to conduct a detailed geophysical investigation of three hectares (ha) of land along the northern and southern edges of the present runway at Upavon Airfield, within the Defence Training Estate of Salisbury Plain, based at Upavon, Wiltshire; the centre position for the survey area is National Grid Reference (NGR) 415140, 154429.

The survey aimed to establish the presence/absence, extent, character and date of archaeological remains in view of modifications to the present runway design. Wessex Archaeology had previously conducted archaeological works on the site which suggested that this site had been continuously occupied from the Neolithic – Bronze Age to Late Roman period.

WA conducted a detailed gradiometer survey covering 2.75ha of land at this site. The results of this survey revealed mainly modern debris. A series of incoherent trends were also identified (**4000** and **4001**) but no definite interpretation could be proposed but their orientation was similar to features found during previous phases of archaeological works.

WATCHKEEPER UAV
UPAVON AIRFIELD, WILTSHIRE

Detailed Gradiometer Survey

Ref. 66373.01

Acknowledgements

This report was commissioned by the Enviros Consulting Ltd on behalf of Debut (SW). Wessex Archaeology would like to acknowledge the assistance of Dave Marks of Upavon Site Estates Office for facilitating access to the study area.

The project was managed on behalf of Wessex Archaeology by Paul White and field work was directed by geophysics manager Paul Baggaley. Field work was conducted by Cristina Serra and Daniel Hart. Cristina Serra processed and interpreted the geophysical data and prepared this report. Illustrations were prepared by Karen Nichols.

WATCHKEEPER UAV
UPAVON AIRFIELD, WILTSHIRE

Detailed Gradiometer Survey

Ref: 66373.01

Contents

1. PROJECT BACKGROUND	1
2. SURVEY AREAS	1
3. METHODOLOGY	2
3.1. APPROACH.....	2
4. RESULTS AND INTERPRETATION.....	2
4.1. INTRODUCTION.....	2
4.2. SURVEY RESULTS AND INTERPRETATIONS.....	2
5. CONCLUSIONS.....	3
6. REFERENCES	4
APPENDIX I: SURVEY EQUIPMENT AND DATA PROCESSING.....	5
Survey Methods and Equipment	5
Post-Processing	5
APPENDIX II: GEOPHYSICAL INTERPRETATION	6

Figures:

- Figure 1 Proposed study areas and coverage of geophysical survey
- Figure 2 Greyscale and XY trace results
- Figure 3 Archaeological interpretation

WATCHKEEPER UAV
UPAVON AIRFIELD, WILTSHIRE

Archaeological Evaluation of Geophysical Data

Ref.66373.01

1. PROJECT BACKGROUND

- 1.1. Wessex Archaeology was commissioned by Enviros Consulting Ltd to conduct a detailed geophysical investigation with a gradiometer system of approximately three hectares (ha) of land along the northern edge of the present runway at Upavon Airfield in view of developing a new runway. The survey is located within Upavon Airfield, part of the Defence Training Estate of Salisbury Plain, Wiltshire; site-centred National Grid Reference (NGR) 415140, 154429.
- 1.2. The aim of the project is to conduct a geophysical survey in an attempt to establish the presence/absence, extent, character and date of archaeological remains within the survey area and to compare them with the results of previous archaeological works.
- 1.3. Wessex Archaeology had previously conducted a desk-based assessment, geophysical surveys and trial trenching (WA 2007a, WA 2007b and WA 2007c). These evaluations have identified a large circular enclosure with clear internal structure along with associated rectilinear boundaries. The material recovered during the excavations suggested this area to have been continuously occupied from the Neolithic – Bronze Age through to the Late Roman period. The assessments considered the enclosure to be of comparable importance to other archaeological sites on Salisbury Plain and of regional, and possibly national, importance.

2. SURVEY AREAS

- 2.1. The site was divided into three survey areas (**Figure 1**) in order to prioritise areas for the survey during the time available for fieldwork. Areas 1 and 2 were surveyed within the time available.
- 2.2. Areas 1 and 2 covered 2.75ha of mainly short grass land at Upavon Airfield. Approximately 0.25ha of Area 1 could not be surveyed due to overgrown vegetation.
- 2.3. The survey area lie wholly upon Cretaceous Upper Chalk and thin brown rendzina soils (Geological Survey of Great Britain 1959 1:50,000 Sheet 282,

Devizes), a geology considered to be suitable for the identification of archaeological remains using magnetic gradiometer techniques.

3. METHODOLOGY

3.1. APPROACH

- 3.1.1. The geophysical investigation consisted of a detailed gradiometer survey. This survey was conducted by WA staff using a Bartington 601-2 dual magnetic gradiometer system and was undertaken on the 11th December 2007.
- 3.1.2. Survey grids were established at 20m x 20m using a Leica 1200 RTK GPS system, which was able to provide accurate locations in real-time to within 2cm and therefore exceed the level of accuracy recommended by English Heritage (1995) for geophysical surveys.
- 3.1.3. Further details of the geophysical and survey equipment, methods and processing are described in **Appendix I**.

4. RESULTS AND INTERPRETATION

4.1. INTRODUCTION

- 4.1.1. The detailed gradiometer survey suffered from rapid temperature changes making the instrument values drift. However, the logged data were of suitable quality to allow an interpretation which revealed numerous anomalies.
- 4.1.2. The data has been presented as a greyscale plot and a XY trace plot in **Figure 2** and the interpretations are presented in **Figure 3**. The latter integrates the archaeological features, trends, ferrous/burnt or fired objects, and areas of general increased magnetic response identified in this dataset and in previous geophysical surveys. Full definitions of these terms are provided in **Appendix II**.

4.2. SURVEY RESULTS AND INTERPRETATIONS

- 4.2.1. The results of the survey identified areas of increased magnetic response and ferrous material. These were interpreted as modern debris associated with track which crossed the survey area and encloses the adjacent runway.
- 4.2.2. Amongst these features, in areas of quieter magnetic response, the data revealed two groups of trends mostly orientated northwest-southeast (**4000-4001**) similar to some of the linear features found during the previous geophysical survey. These trends could not be associated with a particular archaeological feature or context due to weak magnetic response.
- 4.2.3. The geophysical results from this survey provide additional information about a strip of land along the edge of the current runway and can be compared

with the results of previous phase of archaeological works for Upavon Airfield (Archaeological Surveys, 2007).

- 4.2.4 This current survey confirms that the occurrence of archaeological anomalies decreases to the east and north of the circular enclosure found during previous geophysical survey.

5. CONCLUSIONS

- 5.1. The geophysical investigation of Upavon Airfield covered 3 hectares, approximately 75% of the proposed study area with detailed gradiometer survey.
- 5.2. The detailed gradiometer survey successfully revealed features of anthropogenic origin although most of them were of modern character. Two groups of trends were identified (**4000** and **4001**), but they could not be associated with a particular archaeological feature or context.

6. REFERENCES

Archaeological Surveys, 2007, Upavon Airfield: Magnetometry Survey for Wessex Archaeology, unpublished client report, Ref. no. 203.

English Heritage, 1995, *Geophysical survey in archaeological field evaluation*. Research and Professional Service Guideline No 1.

Geological Survey of Great Britain 1959 1:50,000 Sheet 282, Devizes

Wessex Archaeology 2007a, Watchkeeper UAV, Upavon Airfield, Wiltshire. Archaeological Desk-based Assessment, unpublished client report WA ref 66370.01

Wessex Archaeology 2007b, Watchkeeper UAV, Upavon Airfield, Wiltshire. Written Scheme of Investigation for an Archaeological Field Evaluation, unpublished document WA ref 66371.01

Wessex Archaeology 2007c Watchkeeper UAV, Upavon Airfield, Wiltshire, Archaeological Evaluation Report. Unpublished report, WA ref 66371.02

APPENDIX I: 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 with a 1m vertical separation and measures the vertical magnetic gradient as the difference between the total magnetic field at each fluxgate magnetometer. This arrangement of magnetometers suppresses any diurnal or low frequency effects.

The magnetometers have a resolution of 0.1nT and measurements are logged at intervals of 0.25m along traverses spaced 1m apart. All of the data were stored on an integrated data logger for subsequent post-processing and analysis.

WA undertakes two types of magnetic surveys: reconnaissance and detail. No reconnaissance surveys were undertaken during this project.

The detail surveys consist of 20m x 20m grids. Data are collected at 0.25m intervals along reconnaissance transects and the detail traverses, which are 1m apart. This gives at least 80 measurements per transect and 1600 measurements per grid and is the recommended methodology for archaeological surveys of this type (English Heritage, 1995).

The detail survey grids are established using a Leica 1200 RTK GPS system and then extended using tapes. The Leica 1200 RTK GPS system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems allowing positions to be determined to an accuracy of 1-2cm in real-time and therefore exceed the level of accuracy recommended by English Heritage (1995) for geophysical surveys.

Post-Processing

The magnetic data collected during the detail survey were downloaded from the Bartington system for processing and analysis using Archaeosurveyor 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.

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 forward or backward by a number of readings. This corrects for operator errors and is used to enhance linear features;
- Clipping – Limiting the displayed range of the processed data to either $\pm 3\text{nT}$ or $\pm 3\text{s.d.}$ in order to enhance the appearance of smaller anomalies.
- Despike – Filtering any datapoints that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings caused by modern, small ferrous objects at the surface

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 image can include a hidden line algorithm to remove certain lines and enhance the image. This type of image is useful as it shows the full range and shape 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 II: GEOPHYSICAL INTERPRETATION

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

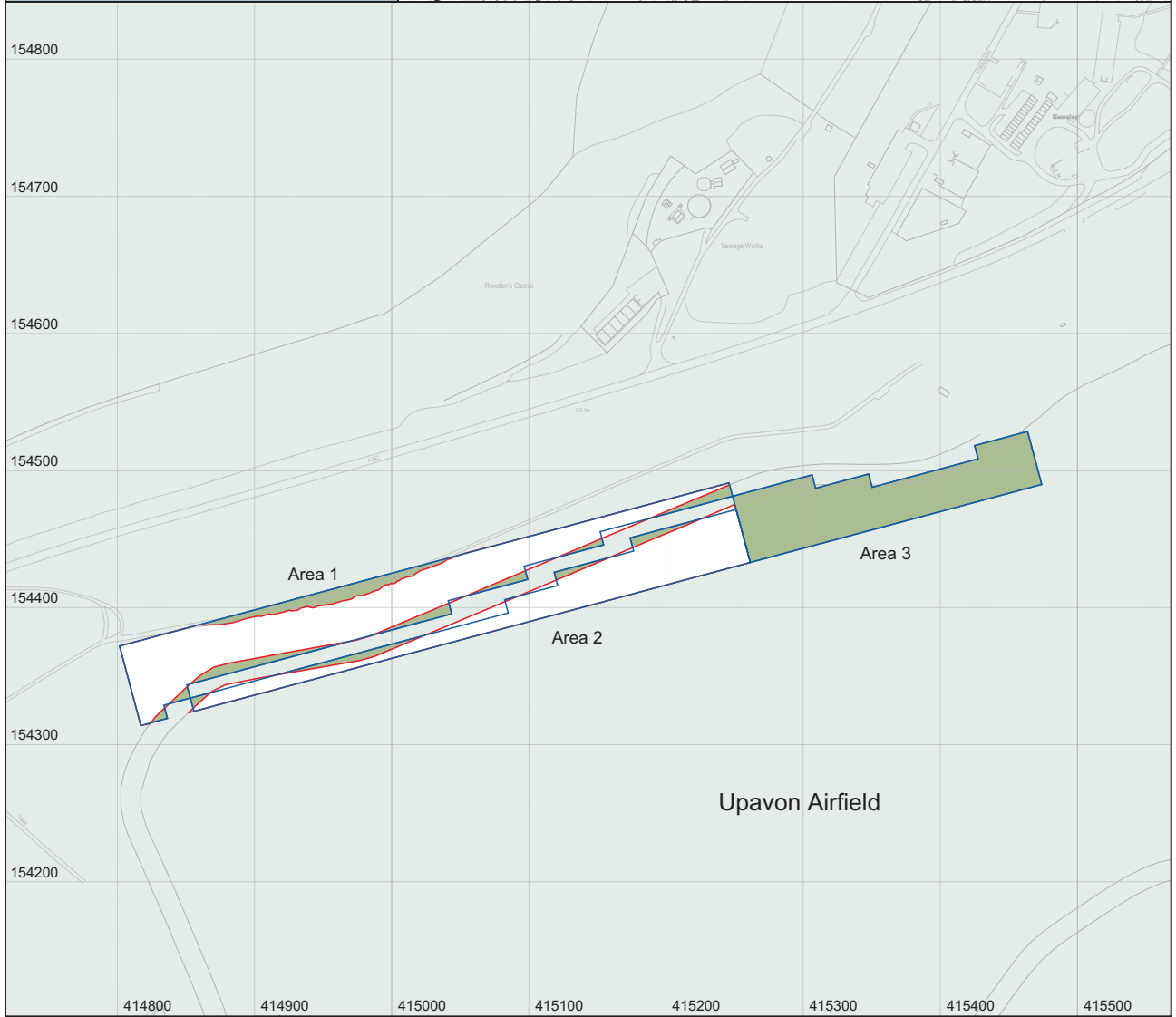
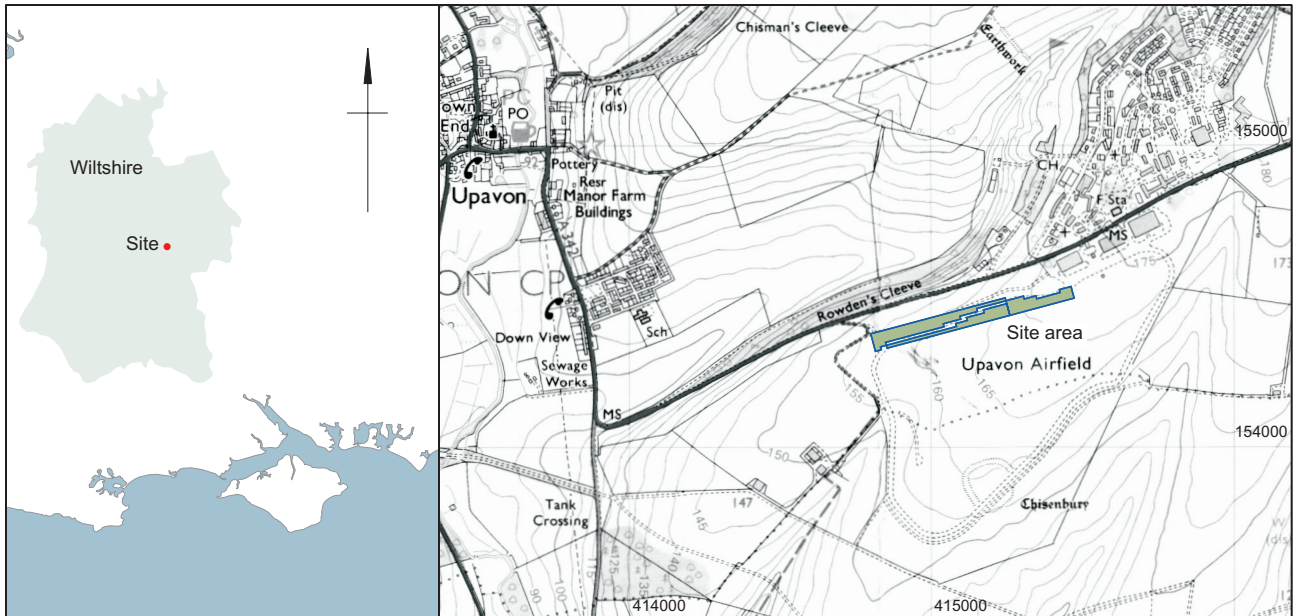
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided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

- Ditch / Pit – used when there is a clear geophysical response, possibly with corroborating evidence of the features presence.
- Archaeology – used when there is a clear geophysical response and anthropogenic pattern.
- Probable archaeology – used for features which give a clear response but which form incomplete patterns.

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:

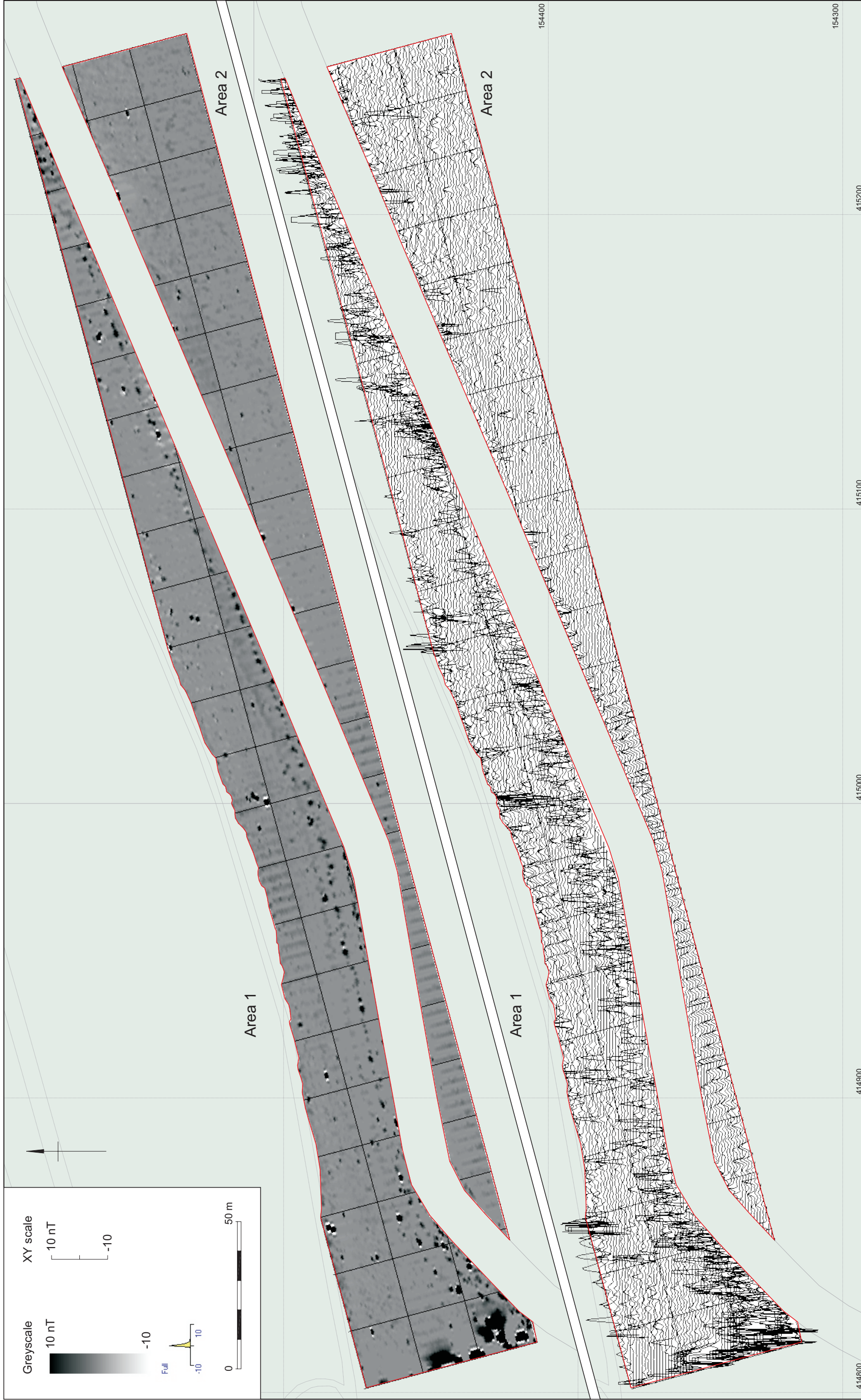
- Possible archaeology – used for features which give a response but which form no discernable pattern or trend.
- Increased magnetic response – used for areas dominated by indistinct anomalies which may have some archaeological potential.
- Trend – used for low amplitude or indistinct linear anomalies.
- Ferrous – used for responses from small amounts of ferrous material. These anomalies are likely to be of modern origin.

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



	Reproduced from the 1998 Ordnance Survey 1:25,000 explorer © map with the permission of the controller of Her Majesty's Stationery Office © Crown copyright, Wessex Archaeology, Portway House, Old Sarum Park, Salisbury, Wiltshire, SP4 6EB. Licence Number: 100028190. Digital data reproduced from Ordnance Survey data © Crown Copyright 2007 All rights reserved. Reference Number: 10003250. This material is for client report only © Wessex Archaeology. No unauthorised reproduction.	
	Date: 18/12/07	Revision Number: 0
	Scale: 1:25,000 1:5000	Illustrator: KMN
	Path: Y:\PROJECTS\66373\DO\RepFigs\GEO\07_12_18	

Proposed study areas and coverage of geophysical survey Figure 1

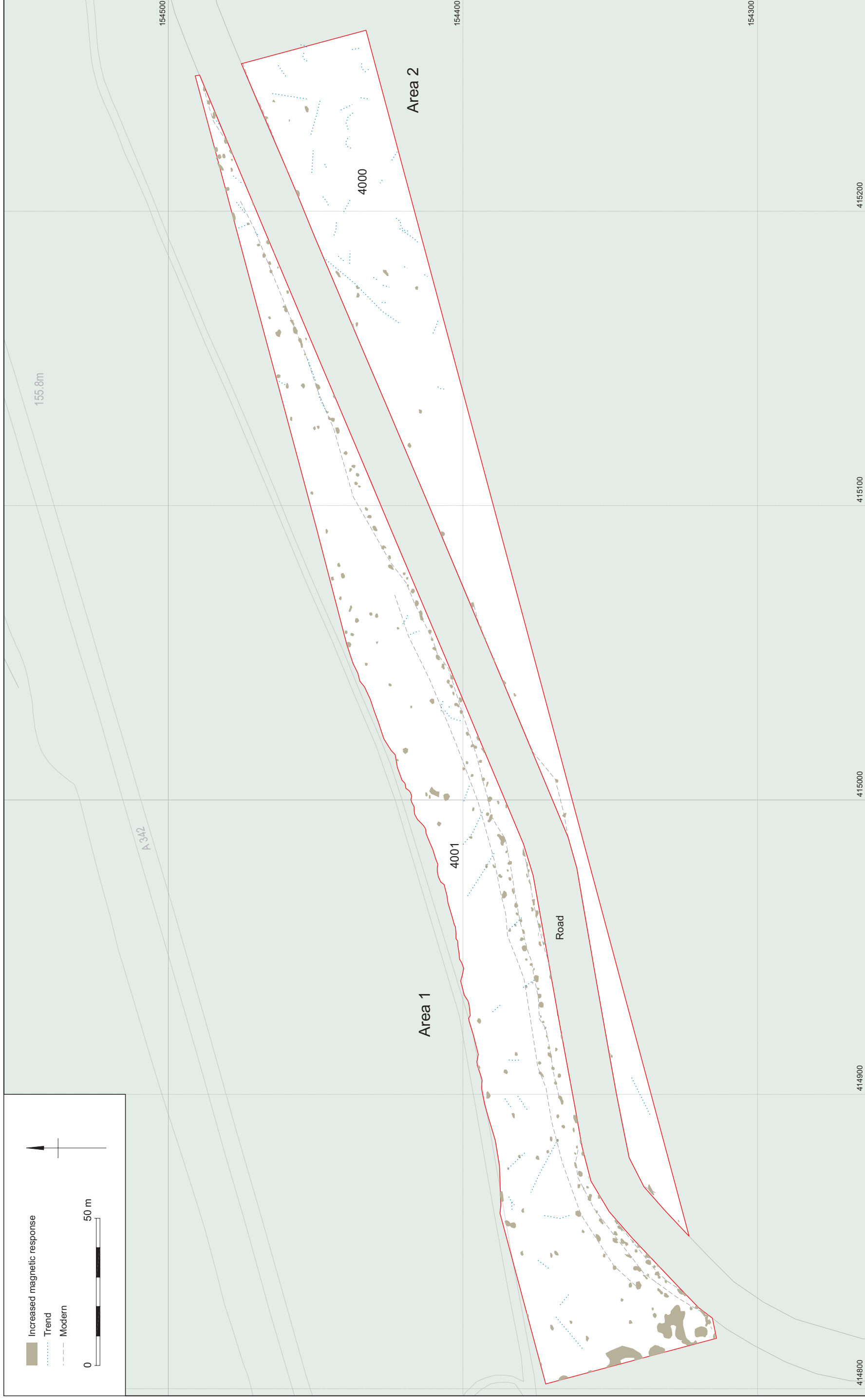


414800		414900		415000		415100		415200		154300	
Digital data reproduced from Ordnance Survey data © Crown Copyright 2007. All rights reserved. Reference Number: 10000280. This material is for client report only © Wessex Archaeology. No unauthorised reproduction.						Date:	18/12/07	Revision Number:	0	Illustration: KMN	
						Scale:	1:1250				
						Path:	Y:\PROJECTS\66373\DO\RepFigs\GEO\07_12_18				



Greyscale plot and XY trace

Figure 2



414800		414900		415000		415100		415200	
<p>Digital data reproduced from Ordnance Survey data © Crown Copyright 2007. All rights reserved. Reference Number: 10002250. This material is for client report only © Wessex Archaeology. No unauthorised reproduction.</p>					<p>Date: 18/12/07</p>		<p>Revision Number: 0</p>		<p>Illustrator: KMN</p>
<p>Wessex Archaeology</p>					<p>Scale: 1:1250</p>		<p>Path: Y:\PROJECTS\66373\DO\RepFigs\GEO\07_12_18</p>		



WESSEX ARCHAEOLOGY LIMITED.

Registered Head Office: Portway House, Old Sarum Park, Salisbury, Wiltshire SP4 6EB.

Tel: 01722 326867 Fax: 01722 337562 info@wessexarch.co.uk www.wessexarch.co.uk

London Office: Unit 113, The Chandlery, 50 Westminster Bridge Road, London SE1 7QY.

Tel: 020 7953 7494 Fax: 020 7953 7499 london-info@wessexarch.co.uk www.wessexarch.co.uk

