ARCHAEOLOGICAL SERVICES WYAS

Ripon Flood Alleviation Scheme,

Birkby Nab

North Yorkshire

Archaeological Investigations

May 2009

Report No. 1954

CLIENT

ENVIRONMENT AGENCY

Ripon Flood Alleviation Scheme
Birkby Nab
North Yorkshire

Archaeological Evaluation

Summary

An archaeological evaluation in advance of the construction phase of the proposed Ripon Flood Alleviation Scheme at Birkby Nab revealed four linear ditches, probably part of a field system, and two post-holes. Unfortunately it has not been possible to date any of these features. Geological features such as palaeo-channels and ice wedges were also noted. No archaeological finds were recovered during the fieldwork.

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Report Information

Client:	Environment Agency
Address:	Phoenix House, Global Avenue, Leeds, LS11 8PG
Report Type:	Archaeological Evaluation
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1 Introduction

Archaeological Services WYAS (ASWYAS) was commissioned by Phil Catherall on behalf of the Environment Agency to undertake a programme of archaeological evaluation comprising geophysical survey (Field G) and trial trenching in advance of the construction phase of the Ripon Flood Alleviation Scheme at Birkby Nab. This report details the results of the evaluation which was carried out between March 9th and April 9th 2009. Geophysical survey had already been undertaken on the remainder of the site (Field F - Harrison and Webb 2006).

Site location and topography

The site is located approximately 3km north-west of Ripon on the River Laver (SE 2755 7265, Figs 1 and 2). Topographically, the site rises from approximately 55m above Ordnance Datum in the north-east to approximately 101m above Ordnance Datum in the north-west. The area is predominantly agricultural.

Soils, geology and land-use

The geology of the site comprises Lower Magnesian Limestone with overlying superficial (drift) deposits of sands and gravels with alluvium adjacent to the river (BGS 1978). The soils are classified in the East Keswick association being typically deep, well drained, fine loams prone to slight seasonal waterlogging, with some coarse loamy soils affected by ground water (SSEW 1983). At the time of the fieldwork, Field F was under a young winter cereal crop. Field G/the Dam Area was under permanent pasture being split into several strips in use as horse paddocks.

2 Archaeological and Historical Background

Prehistoric period

No sites or finds of a Mesolithic date have previously been recorded within the site boundary. The Neolithic period was characterised by the introduction of ritual and funerary monuments, such as the three Thornborough Henges, which were laid out on the same axis about 7km to the north of Ripon, and overlie an earlier *cursus* monument. Three further henges lie about 3km to the west of the town at Hutton Moor, Cana Barn and Nunwick. The massive standing stones known as the Devil's Arrows are also situated 7km to the south-east, outside Boroughbridge. A dense concentration of early Bronze Age monuments have been identified between the River Ure and the River Swale, such as the barrows at Hutton Grange, 4km to the north-east of Ripon. It seems clear that throughout the Neolithic and Bronze Age, the western edge of the Vale of York around Ripon had an important sacred and ritual significance. Extensive areas of Iron Age settlement, including enclosures, farmsteads, trackways and fields systems have been identified across the western edge of the Vale of York (Vyner 2003, 45), although no evidence for Iron Age occupation has been identified within

Ripon. The Ripon area, within the territory of the Brigantes, was annexed by the Romans in about AD 71. There is little evidence for any form of Roman activity within the town, apart from a few residual pieces of Roman pottery found in Anglo-Saxon and medieval contexts during archaeological excavations in Deanery Gardens and at Ripon Cathedral Primary School (Whyman 1997; McComish 2001).

Anglo-Saxon period

In the century following the end of Roman rule in AD 410, the former province fragmented into a number of smaller kingdoms, some of which were controlled by the Romanised British population, and others established by incoming Anglo-Saxon groups from northern Europe. The name 'Ripon' derives from the Old English *Hrypum*, meaning 'amongst the *Hrype*', the *Hrype* being a local Anglo-Saxon tribal group (Smith 1961, 165), although by the early 7th century the area was part of the kingdom of Northumbria. The earliest settlement at Ripon probably originated about AD 657, when land was granted by King Alhfrith of Deira to a group of monks of the Celtic Church to create a daughter house of their monastery at Melrose (Ryder 1990, 1). Following the Synod of Whitby in 664, and the adoption of the Roman liturgy in Northumbria, it appears that the Celtic monks abandoned the site, and it was instead granted to Wilfrid, the Bishop of York, who constructed new monastic buildings here about AD 671-678 (Sherley-Price 1990, 187; Hall and Whyman 1996, 65). The new monastery included 40 hides of land, with a church built of dressed stone, including columns and side aisles (Hall and Whyman 1996, 63). The surviving crypt, beneath the present Ripon Cathedral, is thought to have been part of Wilfrid's original church, which was destroyed in AD 948 (Taylor and Taylor 1965, 301).

Recent archaeological work

Prior to the current phase of evaluation geophysical surveys had been undertaken at several locations (Field B, H, F and Dam Area - Harrison and Webb 2006) to advise on construction design proposals. These surveys identified several anomalies indicative of archaeological activity including a D-shaped enclosure and possible associated features in the field to the east of Dick Hill Wood (Field F). The site immediately south-east of the recorded site of Studley Parva, also known as Studley Roger, a deserted medieval village recorded in the Domesday Book, was also subject to geophysical survey (Field B). Rectilinear anomalies were evident within this field and have been interpreted as possible land divisions or open-ended enclosures (Harrison and Webb 2006).

3 Aims and Objectives

Geophysical Survey

The general aim of the survey was to obtain information on the presence/absence and extent of any archaeology within the area (Field G) likely to be affected by the proposed flood

alleviation works. This information would then enable further evaluation (trial trenching) and/or mitigation measures to be designed in advance of the flood alleviation works.

Trial Trenching

The aim of this stage of the evaluation was to provide detailed information on the presence/ absence, extent, character, date, depth and degree of survival of any archaeological deposits or features identified within the three areas within the site (Field F, Field G and the Dam Area) and to provide an indication of their extent, character, date, significance and level of survival.

All work was undertaken in accordance with a Written Scheme of Investigation (WSI) produced by ASWYAS (Appendix 1) on behalf of the Environment Agency and submitted to and approved by North Yorkshire County Council Heritage Section prior to the commencement of the fieldwork.

The fieldwork was carried out in three stages with the trial trenching in Field F followed by the geophysical survey in Field G and finally the trial trenching in Field G and the dam area.

4 Methodology

Geophysical Survey

A Bartington Grad601 magnetic gradiometer was used to take readings at 0.25m intervals on zig-zag (east-west) traverses 1m apart within 30m by 30m grids so that 3600 readings were recorded in each grid. These readings were stored in the memory of the instrument and later downloaded to computer for processing and interpretation. Geoplot 3 (Geoscan Research) software was used to process and present the data. Further details are given in Appendix 2. Detailed (recorded) survey allows the visualisation of weaker anomalies that may not have been readily identifiable by alternative evaluation techniques such as magnetometer (magnetic) scanning.

The geophysical survey methodology, report and any recommendations comply with guidelines outlined by English Heritage (David *et al.* 2008) and by the IfA (Gaffney *et al.* 2002). All figures reproduced from Ordnance Survey mapping are with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

Technical information on the equipment used, data processing and magnetic survey methodology is given in Appendix 2. Appendix 3 details the survey location information and Appendix 4 describes the composition and location of the survey archive.

The figures in this report have been produced following analysis of the data in 'raw' and processed formats and over a range of different display levels. All figures are presented to

display in the most suitable form and interpret the data from this site based on the experience and knowledge of ASWYAS staff.

Figure 2 shows the processed greyscale magnetometer data and previous magnetometer surveys at 1:5000. The processed and 'raw' (unprocessed) magnetometer data from the survey, together with interpretations of the identified magnetic anomalies, are presented at a scale of 1:1000 in Figures 3, 4 and 5.

Trial Trenching

Seventy-six trenches were located across three areas (Field F, Field G and Dam Area) targeting geophysical anomalies and apparently 'blank' areas (Figs 6 and 7) in order to sample all parts of the site. The trenches were excavated using a 360° tracked excavator equipped with a toothless ditching bucket under archaeological supervision. The stripping was carried out in level spits, each spit of a maximum 0.2m depth, down to the first archaeological horizon or undisturbed natural. The resulting surface and any exposed archaeological features were then cleaned by hand and manually excavated. A sample of 10% of all linear features was excavated. All ditch intersections and termini were investigated. All discrete features were initially 50% excavated, recorded in section and then 100% excavated in accordance with the methodology set out in the WSI (Appendix 1). All archaeological features were recorded in accordance with ASWYAS standard methodology (ASWYAS 2004). A full written, drawn and photographic record of all material revealed during the course of the work was made.

At least 10 litres of soil were sampled from the primary fill of each feature for the potential recovery of carbonised and waterlogged remains, vertebrate remains, molluscs and small artefacts.

The site archive contains all the information gathered during the archaeological evaluation and it is indexed in Appendix 5. The archive is currently held at ASWYAS headquarters but archive deposition will be arranged in due course following consultation with the recipient museum.

5 Geophysical Survey Results

The anomalies identified in this survey fall into four categories as described below.

Ferrous responses/magnetic disturbance

These anomalies are typically caused by ferrous (magnetic) material either on the ground surface or in the topsoil, that cause prompt variations in the magnetic readings resulting in a characteristic 'spiky' XY trace (see Fig. 4). Unless there is supporting evidence for an archaeological interpretation, little importance is normally given to these anomalies as they may be a consequence of modern infilling or ferrous debris deposited as a result of the

current land use. In this survey area, the distribution of ‘iron spikes’ is considered to be random and therefore not of any archaeological significance. Magnetic disturbance has been detected around the easternmost edge of the survey block which is a common feature of modern cultural debris.

Geological anomalies

The majority of magnetic anomalies identified by the survey have been interpreted as having a geological origin (Fig. 5). Due to the location of the survey and its proximity to the River Laver, these anomalies are thought to be caused by infilled river channels and/or spreads of alluvium or river gravel deposited over the flood plain.

Linear trends

Several linear trend anomalies have been identified, the majority of which are aligned north/south. Three isolated linear trends, situated at the south-eastern area of the site, run north-east to south-west. All these anomalies are interpreted as being agricultural in origin, probably being due to ploughing, due to the consistency in alignment and spacing.

Potential archaeological anomalies

Two areas of magnetic enhancement have been interpreted as possibly having an archaeological cause (Fig. 5). In the centre of the survey area, a linear anomaly running 20m north-north-east/south-south-west has been identified. Forty metres to the east of this anomaly is a small cluster of responses that may also be archaeological in origin. However, a geological cause cannot be dismissed.

6 Trial Trenching Results

Summary

The site was divided into three areas, Field F, Field G and the Dam Area with seventy-six trenches located in order to investigate the areas defined in the WSI (Appendix 1). Trenches devoid of archaeological features are briefly summarised in Table 1 but are not described further.

Dark grey brown silty clay ploughsoil covered the site to a maximum depth of 0.52m. The subsoil comprised mid-reddish brown silty clay subsoil up to 0.81m in depth. The archaeological remains recorded during the trenching were predominantly shallow ditches or gullies which were all undated. Two post holes were also identified. Modern land drains and geological features such as palaeochannels and ice wedges were also revealed. These features are described in more detail below.

Field F (Fig. 6)

Forty-six trenches were excavated in this field, with possible archaeological features identified in six of them.

Trench 4 (Fig. 8, S.3; Plate 1)

This trench was orientated north-east to south-west and was positioned to investigate an apparently 'blank' area. A curvilinear ditch feature (109), running on an approximate north to south alignment, was revealed. Ditch 109 measured 1.6m in width by 0.26m in depth and was irregular in profile. It contained two fills (107 and 108), but no datable finds were recovered. This feature was not identified by the geophysical survey.

Trench 7 (Fig. 8 , S.1; Plate 2)

Orientated on a north-east to south-west alignment, this trench contained a single linear feature (103) which corresponded to a geophysical anomaly and has been interpreted as a drainage gully. It possessed a U-shaped profile which measured 0.53m in width by 0.13m in depth and contained a single fill (102). No datable artefacts were found in this feature.

Trench 9 (Fig. 8, S.20 and S.21; Plates 3 and 4)

Excavation of this trench revealed a single ditch and its terminus (143 and 145) which had been identified as a geophysical anomaly. The ditch was orientated approximately east to west and measured between 1.3m to 1.4m in width by 0.5m to 0.62m in depth. It was V-shaped in profile and contained a single fill (142), with frequent medium to large stones inclusions, indicating that it had been intentionally backfilled. No datable finds were retrieved from this feature.

Trench 28 (Fig. 8, S.16; Plate 5)

Located to the east of Field F, this trench was orientated on a north-west to south-east alignment and was positioned to investigate linear anomalies identified by the geophysical survey. Within the centre of the trench a ditch was identified (127), which has been interpreted as a drainage ditch. It measured 1.72m in width by 0.32m in depth and was U-shaped in profile. It contained two fills (126 and 137), with deposit 126 yielding a fragmented iron horse shoe.

Trench 29 (Fig. 9, S.11; Plate 6)

This trench was orientated north-east to south-west and was positioned to target a linear geophysical anomaly. Towards the north-eastern end of the trench, a single ditch (123) was identified. It traversed the trench on a north to south alignment and has been interpreted as having a possible drainage function. Excavation revealed that it measured 1.02m in width by 0.52m in depth, with a U-shaped profile. It contained a single fill (122), but no datable artefacts.

Trench 34 (Fig. 9, S.13; Plate 7)

Located towards the eastern edge of Field F, this trench was positioned to investigate linear anomalies identified in the geophysical survey. The cause of the linear anomalies was not seen but two post-holes (132 and 135) adjacent to the north edge of the trench were identified. Both post-holes contained burnt clay and charcoal rich fills, which may indicate the *in-situ* burning of posts. Whether these features formed part of a larger structure such as fence or possibly a roundhouse is unknown. No datable artefacts were found.

Field G (Figs 2 and 7)

Seventeen trenches were excavated in this field. No archaeological remains were recorded, with only palaeochannels/alluvial features, a land drain (T68) and a cow burial (T64) of recent date identified. The latter feature was not excavated on health and safety grounds following advice from the Environment Agency.

Dam Area (Figs 2 and 7)

Eleven trenches were excavated in this field. No archaeological features or finds were identified. A north-east/south-west aligned ice wedge was identified in Trenches 51 and 56 which corresponded with the linear magnetic anomaly identified by the geophysical survey. No finds were retrieved during the excavation of this area.

Table 1. Summary of results of the trial trenches

Trench	Location	Dimensions (m)	Depth (m)	Topsoil (m)	Subsoil (m)	Geophysical survey	Summary of archaeological remains present
1	Field F	2 x 50	0.41	0.33	0.14	Linear anomalies?	No archaeology
2	Field F	2 x 50	0.35	0.35	0.15	Linear anomalies?	No archaeology
3	Field F	2 x 50	0.39	0.34	0.08	No anomalies	No archaeology
4	Field F	2 x 50	0.31	0.31	N/A	No anomalies	Curvilinear ditch (109)
5	Field F	2 x 50	0.33	0.28	N/A	No anomalies	No archaeology
6	Field F	2 x 50	0.40	0.32	0.10	No anomalies	No archaeology
7	Field F	4 x 24	0.42	0.33	0.11	Linear anomaly	Linear gully (103)
8	Field F	2 x50	0.49	0.32	0.20	No anomalies	No archaeology
9	Field F	5 x 20	0.45	0.30	0.15	Linear anomaly	Linear ditch (143, 145)
10	Field F	2 x 50	0.38	0.21	0.19	No anomalies	No archaeology
11	Field F	4 x 24	0.33	0.33	N/A	Discrete anomalies	No archaeology
12	Field F	2.1 x 50	0.35	0.35	0.05	No anomalies	No archaeology
13	Field F	5 x 20	0.42	0.42	N/A	Linear anomaly?	No archaeology
14	Field F	4 x 25	0.40	0.40	N/A	Discrete anomalies	No archaeology
15	Field F	2 x 50	0.70	0.40	0.30	Discrete anomaly	No archaeology
16	Field F	4 x 25	0.33	0.33	N/A	Linear anomaly?	No archaeology
17	Field F	4.1 x 25	0.30	0.30	N/A	Discrete anomalies	No archaeology
18	Field F	3.9 x 25	0.60	0.40	0.20	Area of enhanced magnetic background	No archaeology
19	Field F	4 x 25	0.68	0.30	0.42	Area of magnetic enhancement	No archaeology
20	Field F	2 x 50	0.40	0.34	0.11	No anomalies	No archaeology
21	Field F	2 x 50	0.41	0.41	N/A	No anomalies	No archaeology

Trench	Location	Dimensions (m)	Depth (m)	Topsoil (m)	Subsoil (m)	Geophysical survey	Summary of archaeological remains present
22	Field F	2 x 50	0.32	0.32	N/A	No anomalies	No archaeology
23	Field F	2 x 50	0.32	0.30	N/A	No anomalies	No archaeology
24	Field F	2 x 50	0.56	0.45	0.17	Discrete areas of enhancement	No archaeology
25	Field F	4 x 25	0.67	0.50	0.24	Discrete areas of enhancement	No archaeology
26	Field F	2 x 50	0.40	0.40	0.10	Discrete areas of enhancement	No archaeology
27	Field F	10 x 10	0.65	0.35	0.30	Discrete areas of enhancement	No archaeology
28	Field F	4 x 25	0.42	0.42	N/A	Discrete areas of enhancement	Linear ditch (127)
29	Field F	2 x 50	0.40	0.40	N/A	Linear anomalies	Linear ditch (123)
30	Field F	4 x 25	0.45	0.35	0.12	Discrete areas of enhancement	No archaeology
31	Field F	2 x 50	0.40	0.30	0.10	Linear anomalies	No archaeology
32	Field F	10 x10	0.40	0.40	N/A	Discrete anomalies	No archaeology
33	Field F	2 x 50	0.40	0.40	N/A	Linear anomalies	No archaeology
34	Field F	2 x 50	0.49	0.31	0.18	Linear anomalies	Two post-holes (132 and 135)
35	Field F	2 x 50	0.40	0.38	0.10	No anomalies	No archaeology
36	Field F	2 x 50	0.45	0.36	N/A	Linear anomalies	No archaeology
37	Field F	2 x 51	0.40	0.30	0.10	No anomalies	No archaeology
38	Field F	2 x 50	0.25	0.25	N/A	No anomalies	No archaeology
39	Field F	2 x 50	0.31	0.31	N/A	No anomalies	No archaeology
40	Field F	2 x 50	0.30	0.30	0.10	No anomalies	No archaeology
41	Field F	2 x 50	0.52	0.52	N/A	No anomalies	Field drain (119)
42	Field F	2 x 50	0.32	0.32	N/A	No anomalies	No archaeology
43	Field F	4 x 27	0.70	0.40	0.30	Discrete areas of enhancement	No archaeology
44	Field F	2 x 50	0.36	0.36	N/A	No anomalies	No archaeology

Trench	Location	Dimensions (m)	Depth (m)	Topsoil (m)	Subsoil (m)	Geophysical survey	Summary of archaeological remains present
45	Field F	2 x 50	0.35	0.35	N/A	No anomalies	Field drain (113)
46	Field F	2 x 51	0.40	0.40	N/A	Linear anomalies	No archaeology
47	Dam Area	2 x 20	0.29	0.30	0.29	No anomalies	No archaeology
48	Dam Area	2 x 20	0.44	0.29	0.15	No anomalies	No archaeology
49	Dam Area	2 x 20	0.70	0.50	0.20	No anomalies	No archaeology
50	Dam Area	2 x 20	0.55	0.32	0.23	No anomalies	No archaeology
51	Dam Area	2 x 22	0.50	0.30	0.20	Linear anomaly	Ice wedge (150)
52	Dam Area	2 x 20	0.40	0.40	N/A	No anomalies	No archaeology
53	Dam Area	2 x 20	0.35	0.29	N/A	No anomalies	No archaeology
54	Dam Area	2 x 20	0.30	0.30	N/A	No anomalies	No archaeology
55	Dam Area	2 x 20	0.43	0.26	0.20	Linear anomaly	Ice wedge
56	Dam Area	2 x 20	1.08	0.30	0.81	No anomalies	No archaeology
57	Dam Area	2 x 20	0.92	0.26	0.70	No anomalies	No archaeology
58	Field G	2 x 50	0.50	0.30	N/A	Linear anomaly	Palaeochannel
59	Field G	2 x 50	0.50	0.30	0.20	Faint linear anomaly	No archaeology
60	Field G	2 x 50	0.70	0.45	N/A	Linear anomaly	Palaeochannel (154)
61	Field G	2 x 50	1.10	0.30	0.30	Faint linear anomaly	No archaeology
62	Field G	2 x 52	1.10	0.40	N/A	No anomalies	No archaeology
63	Field G	4 x 26	0.46	0.40	N/A	Linear anomaly	No archaeology
64	Field G	2 x 50	0.38	0.30	0.09	Linear anomaly	Modern cow burial
65	Field G	2 x 30	0.53	0.32	0.24	Discrete anomalies	No archaeology
66	Field G	5 x 20	0.46	0.30	0.20	Discrete anomalies	No archaeology
67	Field G	2 x 50	0.42	0.28	N/A	Discrete anomalies	No archaeology

Trench	Location	Dimensions (m)	Depth (m)	Topsoil (m)	Subsoil (m)	Geophysical survey	Summary of archaeological remains present
68	Field G	2 x 50	0.36	0.36	N/A	Linear anomaly	Field drain (139)
69	Field G	8 x 12	0.52	0.30	0.22	Linear anomaly	No archaeology
70	Field G	4 x 20	0.54	0.35	0.25	Linear anomaly	No archaeology
71	Field G	2 x 30	0.50	0.35	0.21	No anomalies	No archaeology
72	Field G	2 x 50	0.90	0.30	0.72	No anomalies	No archaeology
73	Field G	2 x 50	0.71	0.34	0.40	No anomalies	No archaeology
74	Field G	8 x 20	1.10	0.60	0.75	Linear anomaly	No archaeology
75	Field G	2 x 50	0.96	0.40	0.29	Linear anomaly	No archaeology

7 Environmental Record

Carbonised Plant Macrofossils and Charcoal by Diane Alldritt

Introduction

A total of eight environmental sample flots from excavations at Ripon Flood Alleviation (RFA09) were examined for carbonised plant macrofossils and charcoal. Three bags of charred material sorted from the retent portions of the samples were also analysed. Charcoal from Sample 4 (131) and Sample 5 (134) was identified in order to find suitable short-lived pieces for radiocarbon dating.

Methodology

Bulk environmental samples were processed by Archaeological Services WYAS using an Ankara style water flotation system (French 1971). The flots were subsequently dried prior to being examined with the aid of a low powered binocular microscope. Four of the samples produced very small quantities of charred material with approximately >2.5ml tea-leaf sized charred fragments recovered. Two of the samples produced no carbonised remains. Sample 4 (131) and Sample 5 (134) proved the most abundant with 25ml and 70ml of wood charcoal fragments respectively.

Modern root fragments were present in fairly small background amounts from 5ml to 10ml together with very occasional modern (non-carbonised) seeds, indicating a reasonably low level of modern contamination. All identified plant remains including charcoal were removed and bagged separately by type.

All wood charcoal fragments from (131) and (134) were rapidly scanned under low power in order to distinguish any short-lived types present. Unfortunately all was found to be oak type and a selection of this was bagged for comparative purposes. Full identification of selected fragments was carried out using a high powered Vickers M10 metallurgical microscope at magnifications up to x200. The reference photographs of Schweingruber (1990) were consulted for charcoal identification. Plant nomenclature utilised in the text follows Stace (1997) for all vascular plants apart from cereals, which follow Zohary and Hopf (2000).

Results

Results are presented and discussed in Table 2 and below.

	Sample	1	3	4	5	6	7	8	9
	Context	102	122	131	134	126	142	144	154
	Total CV	0	<2.5ml	25ml	70ml	0	<2.5ml	<2.5ml	<2.5ml
	Modern	10ml	10ml	10ml	10ml	5ml	5ml	5ml	10ml
Carbonised Cereal Grain	**Common Name**								
Indeterminate Cereal Grain (+embryo)							1		
Charcoal									
Quercus	Oak			11+ (2.79g)	12+ (2.33g)				
Other Carbonised Remains									
Whole bud									1
Other Remains									
Modern (non-carbonised) weeds								5+	

Table 2 Carbonised plant remains, charcoal and other material

Discussion

The eight environmental samples produced very few carbonised plant remains, with wood charcoal constituting the largest category of material recovered. Very scarce amounts, probably trace or accidental occurrences, of cereal grain and a single bud were also present.

A single indeterminate carbonised cereal grain was found in Sample 7 (142) in a poor state of preservation. This was most likely trace or wind-blown material and probably not significant. No carbonised weed seeds were recovered from the samples. A whole indeterminate bud from Sample 9 (154) probably became accidentally carbonised when wood was cut and brought to the site for fuel.

Wood charcoal was recovered primarily from Sample 4 (131) and Sample 5 (134) with smaller indeterminate slivers of charcoal present in the retent of Sample 7 (142). All fragments of charcoal from (131) and (134) were examined with a view to identifying pieces for radiocarbon dating, but all were found to be Quercus (oak) type. No short-lived types were present in either of the samples. The presence of two quite large amounts of oak charcoal suggested the cutting of deciduous woodland for fuel, with an ample supply of oak available for use on hearths or in fire-pits for cooking, heating and so forth. Oak may also have been used for metalworking processes, as it has a high calorific value, producing a long-lasting heat (Gale and Cutler 2000), but no evidence for metalworking waste was found in the samples, so it was more likely just being used as a domestic fuel at the site.

Conclusion

The environmental samples have produced a narrow range of carbonised plant material consisting mainly of wood charcoal, with only single trace specimens of cereal grain and a plant bud. The cereal grain was indeterminate and is probably not a significant find, perhaps being wind-blown from elsewhere.

Wood charcoal was concentrated in Sample 4 (131) and Sample 5 (134) and was found to be exclusively oak type. No short-lived material suitable for radiocarbon dating was present. Oak was probably the main source of fuel in use at the site, with no evidence for other fuel types such as peat, or indeed other types of wood, present in any of the samples.

8 Discussion and Conclusions

Overall the geophysical surveys undertaken in all three parts of the site have proved to have given a reliable indication of the actual level of archaeology present. Where no features could be identified correlating with linear anomalies this almost certainly indicates that they were due to the effects of modern ploughing rather than to a cut feature that was not seen in plan.

In Field F where trenches were targeted on discrete areas of magnetic enhancement no archaeological features were identified. In all cases the anomalies were confirmed as having a geological cause being due to either variations in the composition of the subsoil or natural or to the accumulation (increased depth) of soils found at the bottom of slopes such as in Trenches 18 and 19.

No archaeological features were identified in the trenches in Field G where trenches were targeted on discrete areas of magnetic enhancement. Here the anomalies were due to the presence of a palaeochannel (Trenches 58 and 60) whose alignment fairly closely matches the current course of the River Laver and to other changes in the geology, primarily the presence of pockets of alluvium. Indeed no probable archaeological features were identified in the trenches in Field G or in the Dam Area. This should not be seen as surprising given the low lying nature of the site and the proximity of the river.

In Field F possible archaeological features were recorded in six trenches. These mainly comprised relatively shallow, linear, ditch type features. Unfortunately no finds or environmental evidence was recovered from any of the features to ascertain either date or function. These ditches may form part of a field system, perhaps contiguous with a larger system running across the wider landscape and associated with the D-shaped enclosure (identified to the north-west of Field F by geophysical survey (Harrison and Webb 2006). Alternatively they may be much more recent in origin, perhaps functioning in part as drainage features.

The post-holes identified within Trench 34 are intriguing and provide scant evidence for possible occupation within this part of the site. Unfortunately, as with the linear features, the post-holes remain undated as no artefacts were recovered and no material suitable for C14 dating was present. Whether they formed part of a larger structure/fence is uncl

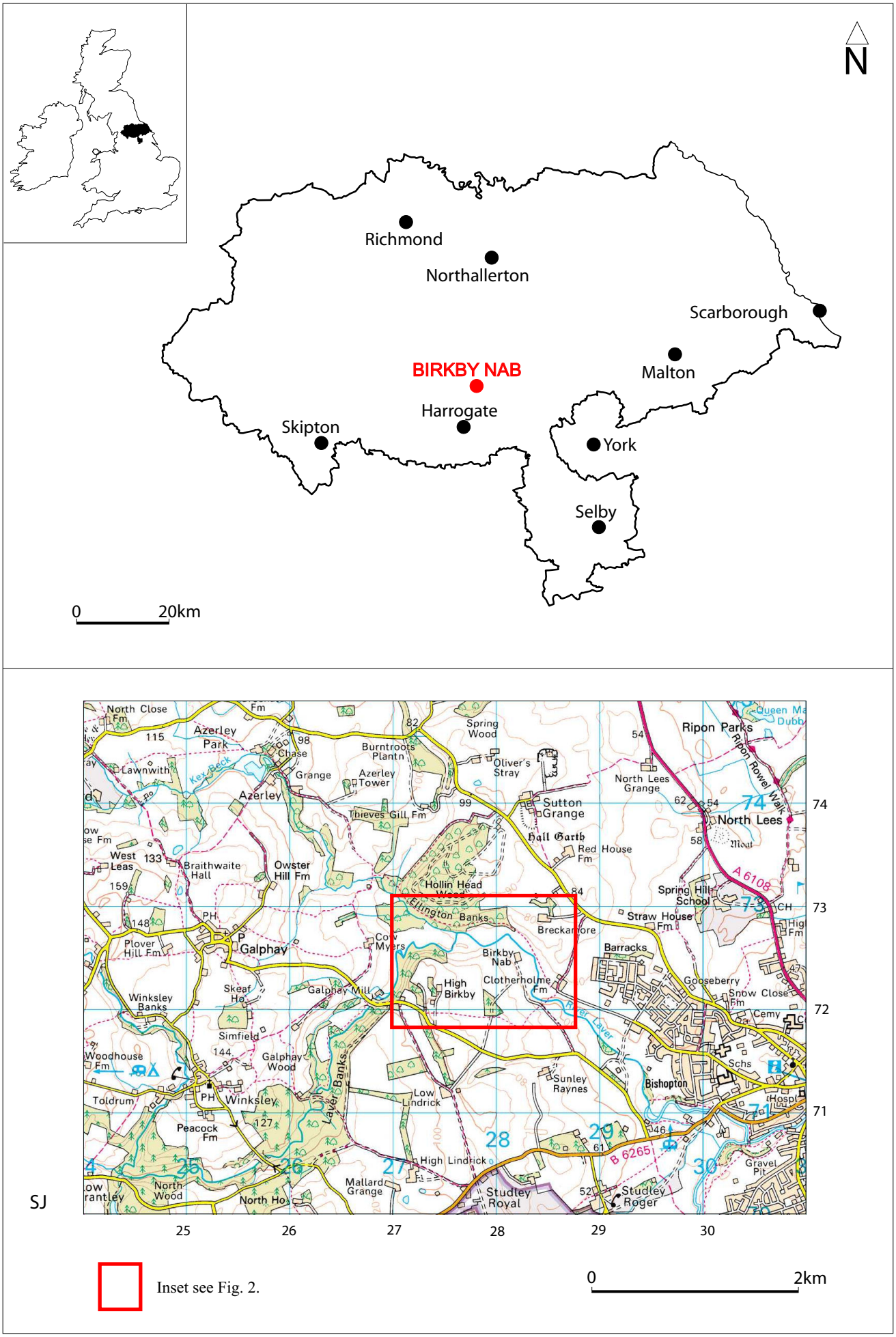

Fig. 1. Site location

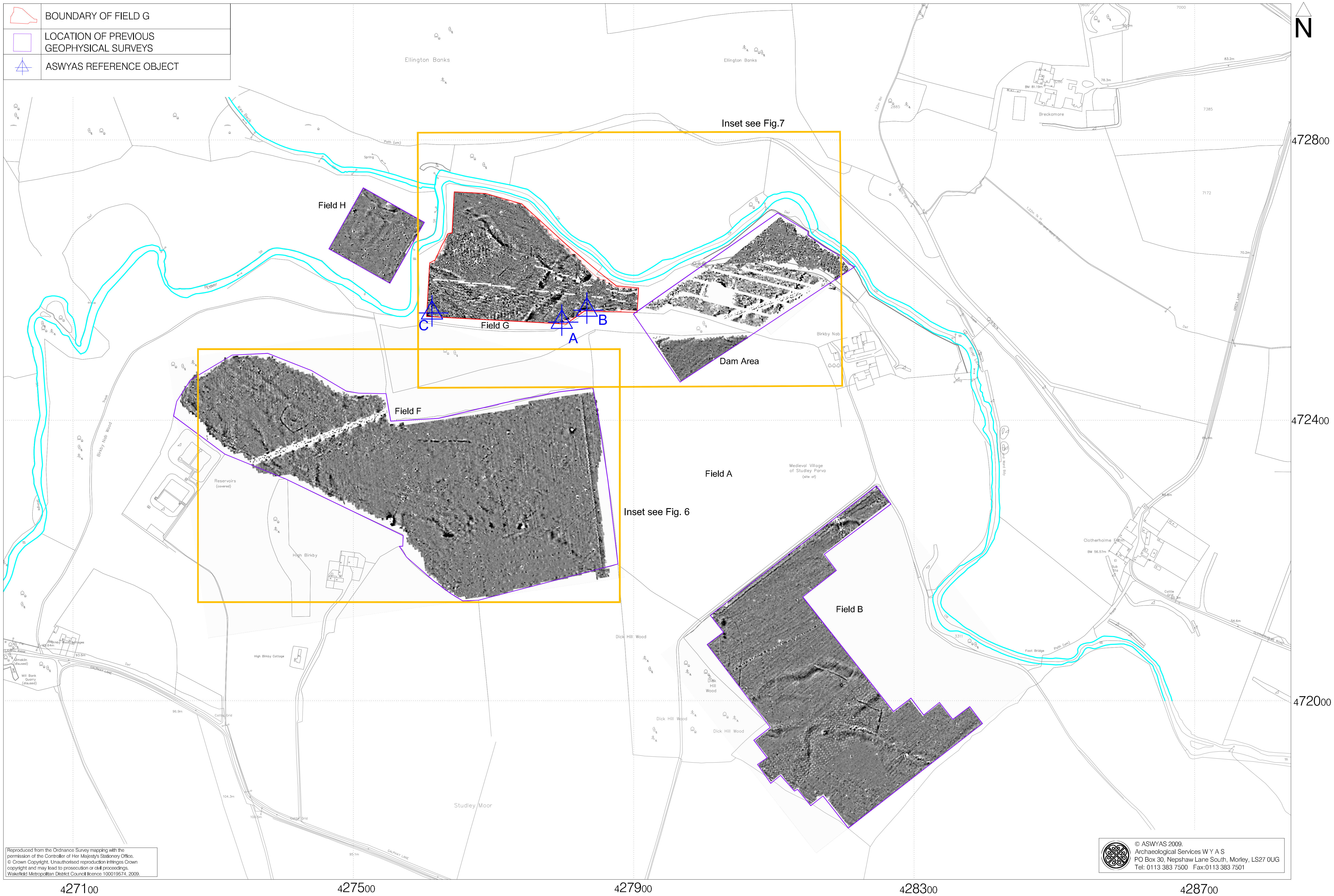

Fig. 2. Site location showing previous geophysical survey and Field G greyscale magnetometer data (1:5000 @ A3)

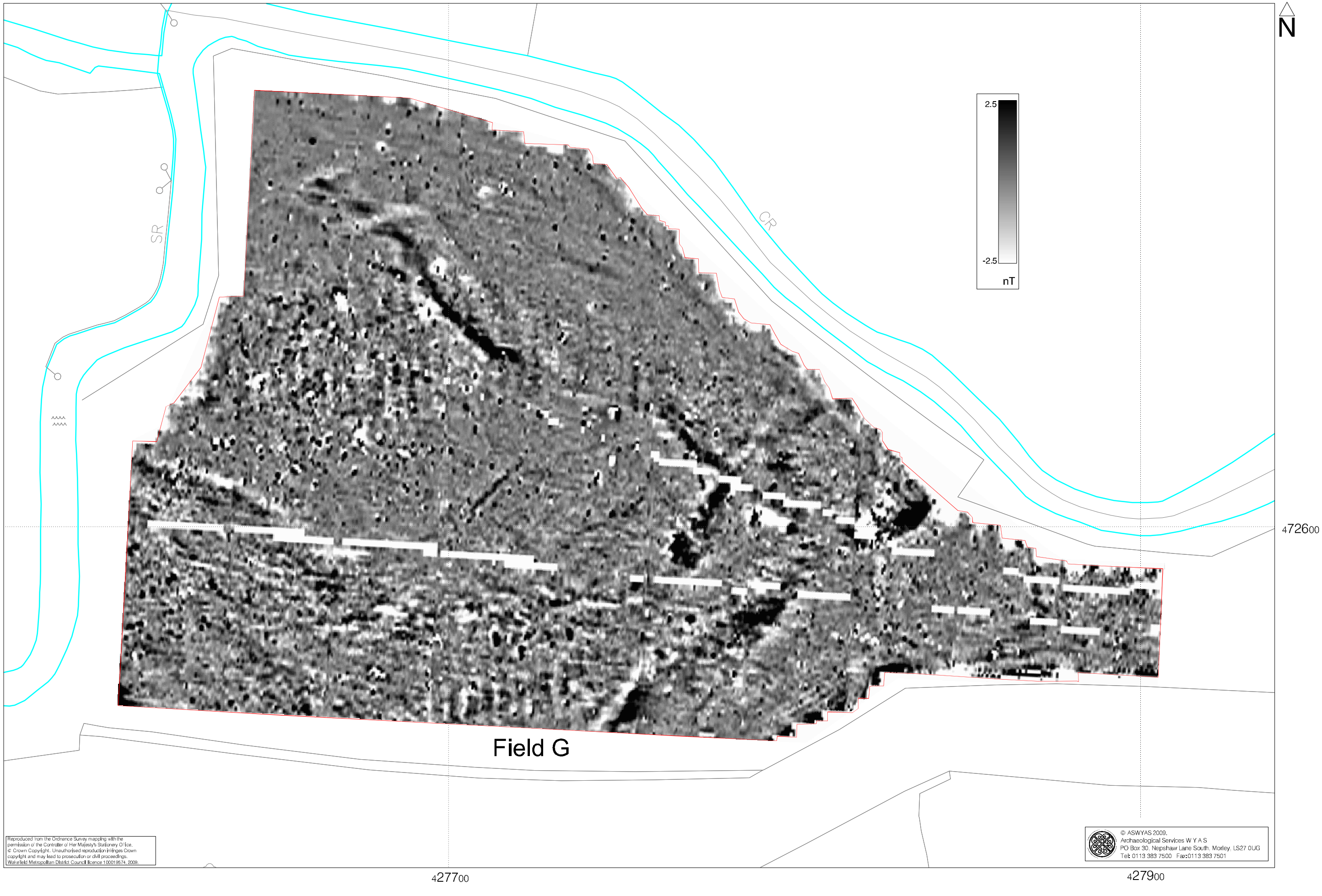

Fig. 3. Processed greyscale magnetometer data from Field G (1:1000 @ A3)

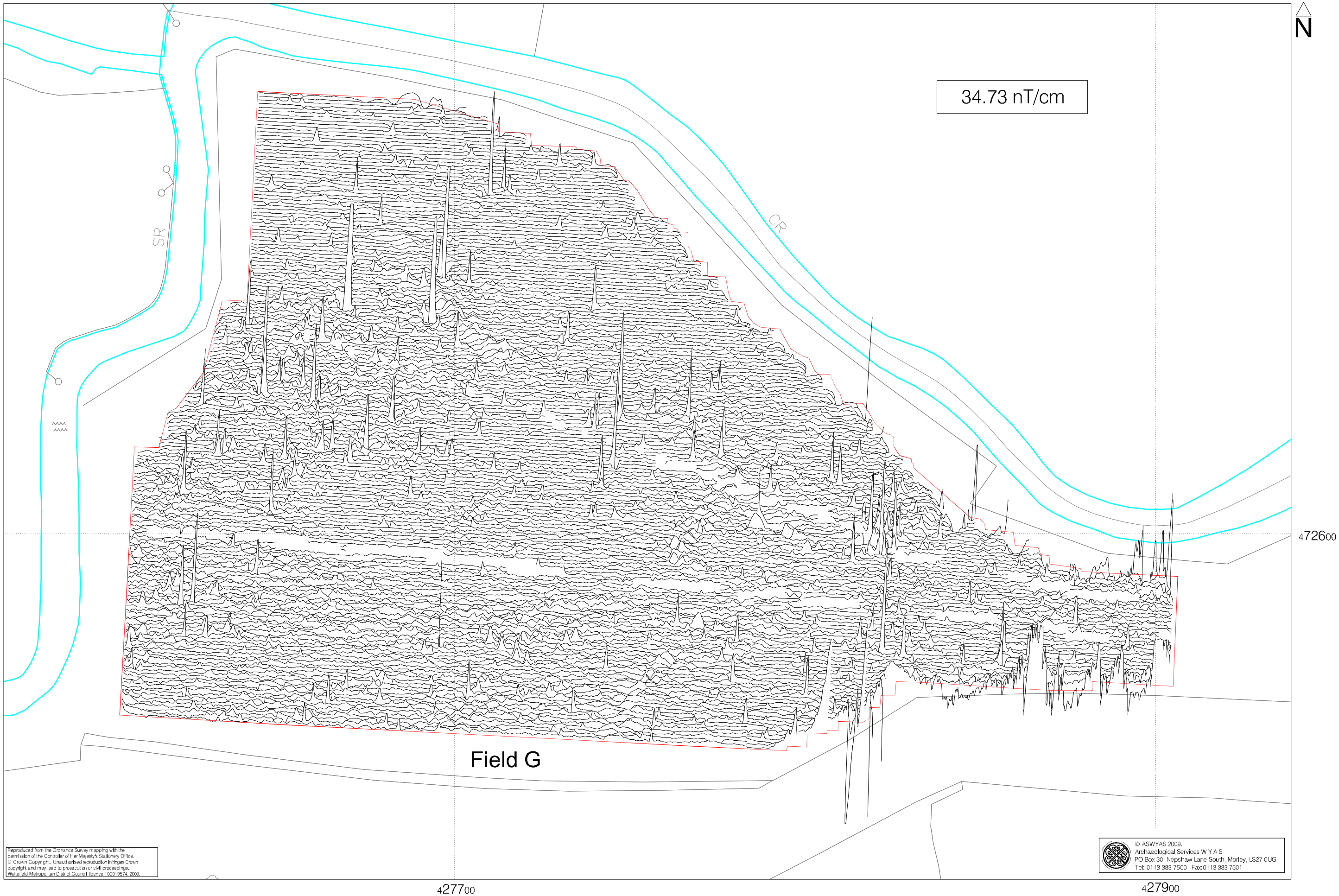

Fig. 4. XY trace plot of unprocessed magnetometer data from Field G (1:1000 @ A3)

TYPE OF ANOMALY		INTERPRETATION
•	DIPOLAR ISOLATED	FERROUS MATERIAL
	MAGNETIC DISTURBANCE	FERROUS MATERIAL
	MAGNETIC ENHANCEMENT	MODERN?\ARCHAEOLOGY ?
	MAGNETIC ENHANCEMENT	GEOLOGY
	LINEAR TREND	AGRICULTURAL

N

SR

CR

Field G

4726 00

4277 00

4279 00

0 50m

Archaeological Services W Y A S
PO Box 30, Nepshaw Lane South, Morley, LS27 0UG
Tel: 0113 383 7500 Fax:0113 383 7501

Fig. 5. Interpretation of magnetometer data from Field G (1:1000 @ A3)

GEOPHYSICAL SURVEY

TRIAL TRENCH

69

Field F

High Birkby

N

4724 00

4722 00

4275 00

4277 00

0 100m

Archaeological Services W Y A S
PO Box 30, Nepshaw Lane South, Morley, LS27 0UG
Tel: 0113 383 7500 Fax:0113 383 7501

Fig. 6. Plan showing trenches in Field F, in relation to processed greyscale magnetometer data (1:1500 @ A3)

GEOPHYSICAL SURVEY

69 TRIAL TRENCH

RIVER

N

472800

472600

427700

427900

Track

SR

CR

Def

Field G

Dam Area

0 100m

Fig. 7. Plan showing trenches in Field G and Dam Area, in relation to processed greyscale magnetometer data (1:1500 @ A3)

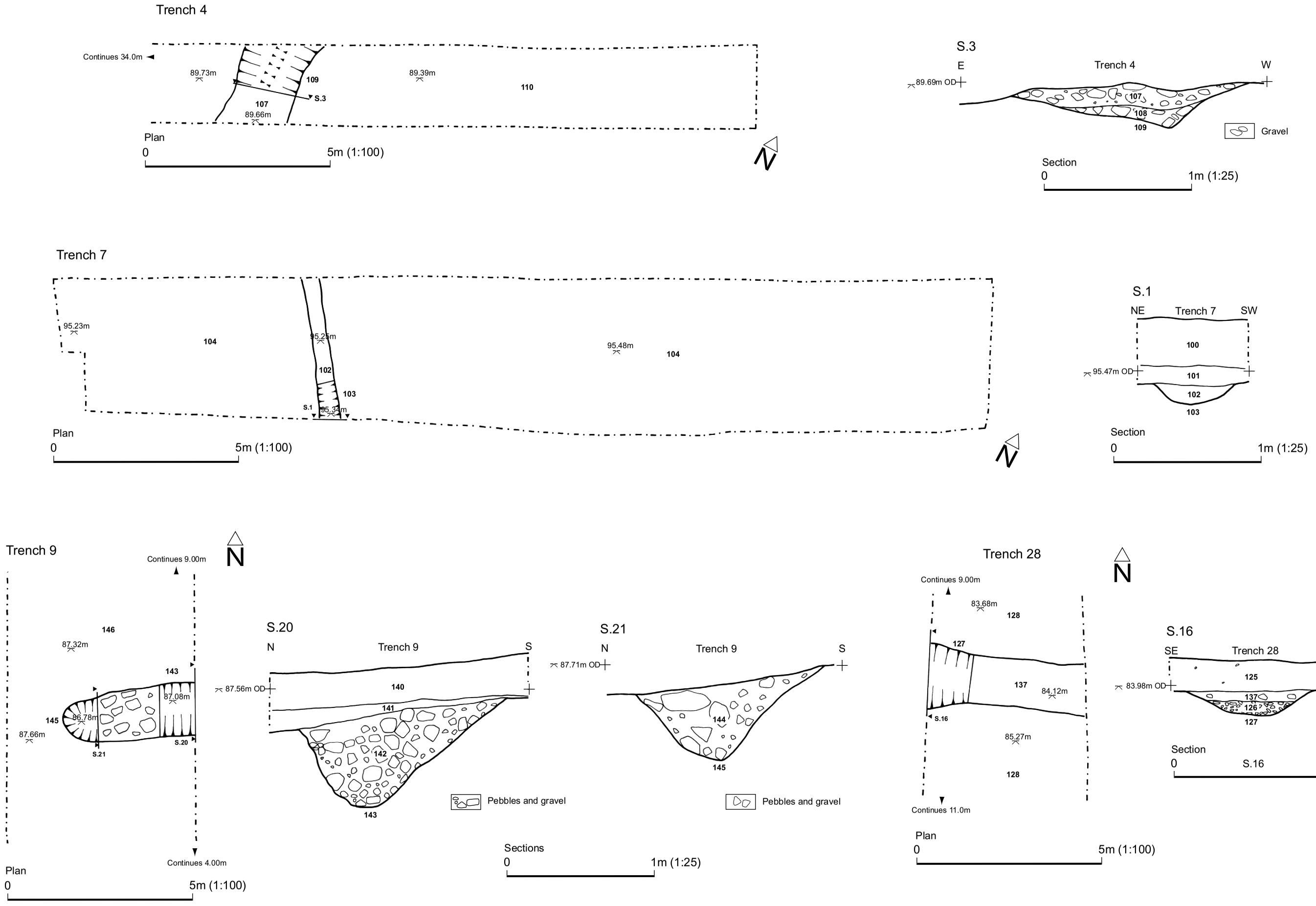

Fig. 8. Plans and sections of Trenches 4, 7, 9 and 28

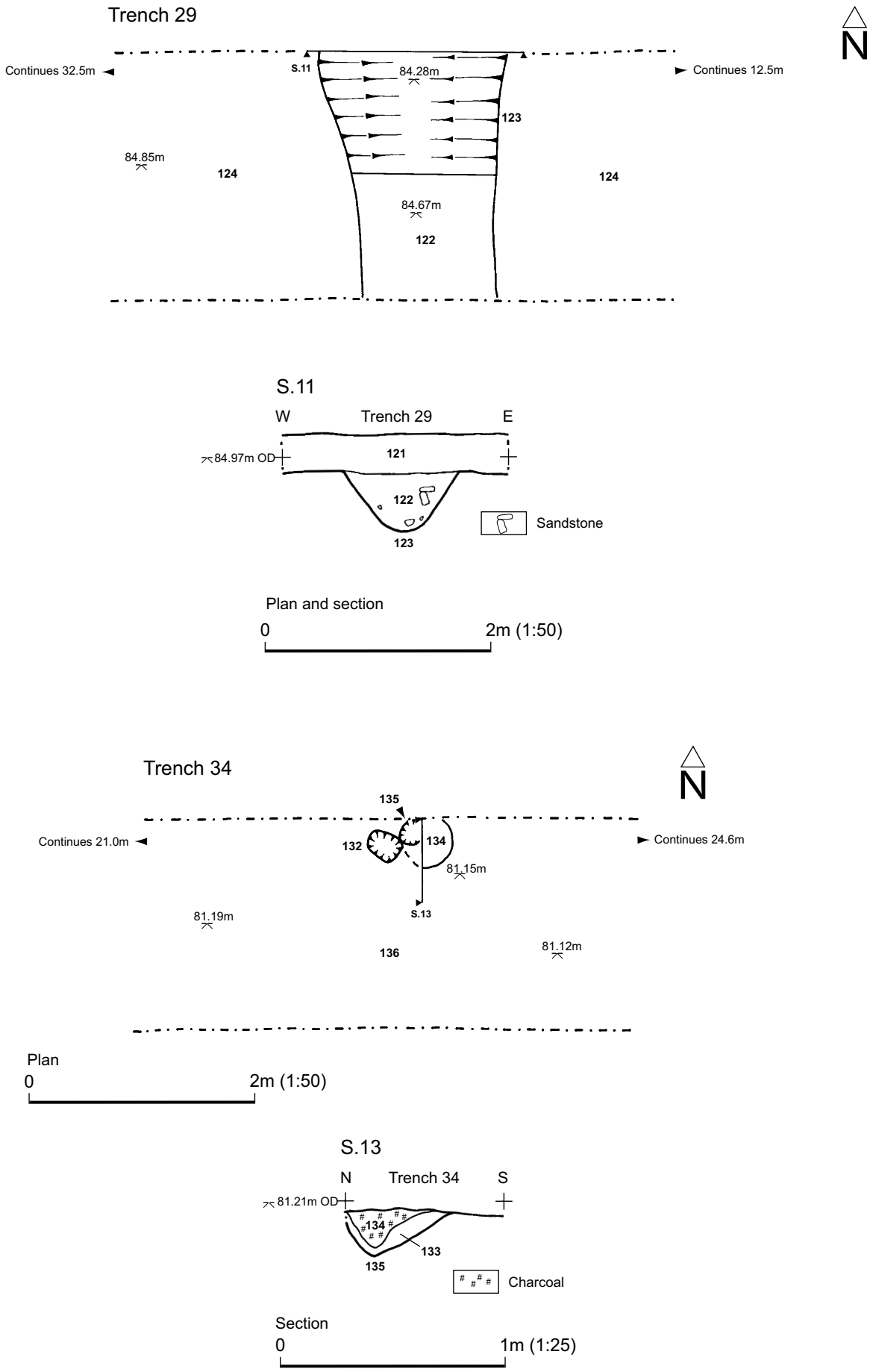

Fig. 9. Plans and sections of Trenches 29 and 34

Plate 1. Trench 4, ditch 109, looking north-west

Plate 2. Trench 7, gully 103, looking south-east

Plate 3. Trench 9, general shot of ditch 143 and 145, looking east

Plate 4. Trench 9, ditch 145, looking east

Plate 5. Trench 28, ditch 127, looking south-west

Plate 6. Trench 29, ditch 123, looking north

Plate 7. Trench 34, post-holes 132 and 135, looking east

Plate 8. Field F looking east following backfilling.

Plate 9. Dam area looking east following backfilling.

Plate 10. Field G looking north-west following backfilling.

Plate 11. Section through a field drain, Trench 45.

Plate 12. Sondage through palaeochannel, Trench 76.

Appendix 1: Written Scheme of Investigation

Ripon Flood Alleviation Scheme
Birkby Nab
North Yorkshire

Written Scheme of Investigation for a Programme of Archaeological Works

1. Introduction

1.1 An archaeological scheme of recording is required in advance of the construction phase of the proposed Ripon Flood Alleviation Scheme at Birkby Nab. This document is prepared to fulfil the North Yorkshire County Council (Heritage and Environment Section) requirement for a programme of archaeological work as a condition of approval of the planning application and is produced by Archaeological Services WYAS at the request of Phil Catherall, of the Environment Agency.

2. Site location

2.1 The site is located approximately 3km north-west of Ripon on the River Laver and is centred at SE 2755 7265. Topographically the site gently rises to the north-west being situated at about 60m above Ordnance Datum. The geology comprises drift deposits of sands and gravels and alluvial material overlying Lower Magnesian Limestone. The soils are deep, well-drained loams prone to seasonal waterlogging.

3. Archaeological Background

3.1 Geophysical survey covering 16 hectares has been undertaken at several locations (Catherall 2004 and Harrison and Webb 2006) prior to the finalisation of the construction design proposals. These none-intrusive surveys have identified several anomalies that have been interpreted as potentially archaeological in nature as well as others due to agricultural practice and geology/soils.

4. Evaluation Methodology

Aims

4.1 The aim of this stage of the evaluation is to provide detailed information on the presence or absence of the extent, character, date, depth of burial and degree of survival of archaeological deposits and features identified within the three areas within the site and to provide an indication of their extent character, date, significance and level of survival.

Scope of Work

4.2 Two areas for further evaluation have been identified following geophysical survey:-

- Field F – this area is the preferred location of the borrow pit from which material will be quarried for the construction of the earthwork dam. Geophysical survey has been undertaken here and potentially archaeological anomalies identified. Trial Trenching to cover 5% of the area (4600m²) will be undertaken in this area (see attached plan and rationale below).

- Southern limb of the dam. Trial trenching to cover the dam area will be undertaken to cover 5% of the area (412m²). This may necessitate some supplementary geophysical survey prior to the determination of trench location.

An additional area for initial evaluation has also been identified:-

- Field G – material from this location will also be extracted for use in the construction programme. Geophysical survey to cover the full area (3.8 hectares) will be undertaken (see attached figure). Following consultation a scheme of trial trenching (up to 5% of the area – 1910m²) will be proposed to evaluate any anomalies identified as well as apparently 'blank' areas.

Rationale – Field F

Trench No.	Area	Rationale
1	50m x 2m	Investigate linear anomalies
2	50m x 2m	Investigate two magnetic anomalies
3	50m x 2m	Investigate apparently 'blank' area
4	50m x 2m	Investigate apparently 'blank' area
5	50m x 2m	Investigate apparently 'blank' area
6	50m x 2m	Investigate apparently 'blank' area
7	25m x 4m	Investigate linear magnetic anomaly
8	50m x 2m	Investigate apparently 'blank' area
9	20m x 5m	Investigate linear anomaly
10	50m x 2m	Investigate 'blank' area
11	25m x 4m	Investigate linear alignment of discrete anomalies
12	50m x 2m	Investigate 'blank' area
13	20m x 5m	Investigate linear anomaly
14	25m x 4m	Investigate cluster of discrete anomalies

Trench No.	Area	Rationale
15	50m x 2m	Investigate discrete anomaly
16	25m x 4m	Investigate terminus of linear anomaly
17	25m x 4m	Investigate cluster of discrete anomalies
18	25m x 4m	Investigate area of enhanced magnetic background
19	25m x 4m	Investigate large discrete area of magnetic enhancement
20	50m x 2m	Investigate apparently 'blank' area
21	50m x 2m	Investigate apparently 'blank' area
22	50m x 2m	Investigate apparently 'blank' area
23	50m x 2m	Investigate apparently 'blank' area
24	50m x 2m	Investigate discrete areas of enhancement
25	25m x 4m	Investigate discrete areas of enhancement
26	50m x 2m	Investigate discrete areas of enhancement
27	10m x 10m	Investigate discrete areas of enhancement
28	25m x 4m	Investigate discrete areas of enhancement
29	50m x 2m	Investigate linear anomalies
30	25m x 4m	Investigate discrete areas of enhancement
31	50m x 2m	Investigate linear anomalies
32	10m x 10m	Investigate four discrete anomalies
33	50m x 2m	Investigate linear anomalies
34	50m x 2m	Investigate linear anomalies
35	50m x 2m	Investigate apparently 'blank' area
36	50m x 2m	Investigate linear anomalies
37	50m x 2m	Investigate apparently 'blank' area
38	50m x 2m	Investigate apparently 'blank' area
39	50m x 2m	Investigate apparently 'blank' area
40	50m x 2m	Investigate apparently 'blank' area
41	50m x 2m	Investigate apparently 'blank' area
42	50m x 2m	Investigate apparently 'blank' area
43	25m x 4m	Investigate discrete areas of enhancement
44	50m x 2m	Investigate apparently 'blank' area
45	50m x 2m	Investigate apparently 'blank' area
46	50m x 2m	Investigate linear anomalies

Trench No.	Area	Rationale
TOTAL	**4600m²**	

Rationale – Dam Site

Trench No	Area	Rationale
47	20m x 2m	Investigate apparently 'blank' area
48	20m x 2m	Investigate apparently 'blank' area
49	20m x 2m	Investigate apparently 'blank' area
50	20m x 2m	Investigate apparently 'blank' area
51	20m x 2m	Investigate linear anomaly
52	20m x 2m	Investigate apparently 'blank' area
53	20m x 2m	Investigate apparently 'blank' area
54	20m x 2m	Investigate apparently 'blank' area
55	20m x 2m	Investigate linear anomaly
56	20m x 2m	Investigate apparently 'blank' area
57	20m x 2m	Investigate apparently 'blank' area
TOTAL	**440m²**	

Methodology

Geophysical Survey

4.3 Archaeological Services WYAS will set out all survey areas using a Trimble 5600 total station theodolite. The site grid will be tied into permanent landscape features and superimposed onto digital data supplied by the client. Survey stations and semi-permanent marker pegs will be left on site, so that the grid can be accurately re-located by a third party.

4.4 A fluxgate gradiometer (Bartington Grad601) will be used. Readings will be taken at 0.25m intervals on zig-zag traverses 1m apart within 20m by 20m grids such that 1600 readings will be taken in each grid. These readings are stored in the memory of the instrument and are later downloaded to computer for processing and interpretation. Geoplot 3 (Geoscan Research) software will be used to process and present the data. The data will be interpreted and presented at suitable scales and located on Ordnance Survey base maps as requested. Processed greyscale, raw XY trace plots and interpretations will be presented at a scale no less than 1:1000 in the report.

4.5 The survey methodology, report and any recommendations will comply with guidelines outlined by English Heritage (David *et al* 2008) and by the IFA (Gaffney, Gater and Ovenden 2002). All figures reproduced from Ordnance Survey mapping are done so with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

4.6 Interim plots and interpretations will be produced immediately on completion of the fieldwork so that a trenching proposal can be produced. The survey results will be incorporated into the trial trench evaluation report. This will be include all relevant information including archaeological and planning background, aims, results, discussion and conclusion as well as all technical and processing information. A project archive will be prepared in accordance with recent good practice guidelines and submitted to the client in acceptable formats. The geophysical archive will comprise:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Word 2000), and graphics files (Adobe Illustrator and AutoCAD 2007) files.

- a full copy of the report

Trial Trenching

4.7 The controlled stripping of ploughsoil, to the archaeologically required level, shall be carried out using a 360º tracked excavator equipped with a toothless ditching bucket under archaeological supervision. Stripping will take place in level spits to the top of the first archaeological horizon or undisturbed natural. The resulting surface will be inspected for archaeological remains. Where archaeological remains require clarification, the relevant area will be cleaned by hand. Under no circumstances will the machine be used to cut arbitrary trenches down to natural deposits, nor shall plant run upon the stripped area unless it is agreed with the supervising archaeologist.

4.8 Archaeological Services WYAS will first plan and then manually excavate a sample of all archaeological features in an archaeologically controlled and stratigraphic manner in order to meet the aims and objectives outlined above. The features will be investigated employing the following sampling strategies:

- Linear features: sufficient excavation will be carried out to investigate the depth, profile and fills of a ditch or gully and to recover dating and environmental evidence from its fills. Normally this will involve a minimum of 10% sample dispersed along the length of the feature (each sample section to be not less than 1m), or a minimum of a 1m sample section if the feature is less than 10m long or if only a small part of it is exposed. With respect to trial trenches, one 1m section will be located and recorded adjacent to the trench edge. Feature intersections will always be excavated in such a way to determine a stratigraphic relationship.

- Discrete features: pits, post–holes and other discrete features will normally be half-sectioned to determine and record their form with a minimum sample of 50% of discrete features in each area. The complete excavation of such features may be appropriate, but only following consultation with the North Yorkshire Heritage Unit.

4.9 A full written, drawn and photographic record of all material revealed during the course of the work shall be made. The excavation limits will be surveyed using electronic survey equipment with larger scale hand drawn plans of features at 1:20 or 1:50, as appropriate. Sections of linear and discrete features will be drawn at 1:10. All sections, plans and elevations will include spot-heights related to Ordnance Datum in metres as correct to two decimal places and survey. Tie-in information will be undertaken during the course of the evaluation and will be fixed in relation to nearby permanent structures and roads and to the National Grid.

4.10 All artefacts recovered will be retained and removed from the site for assessment and analysis, and where it is appropriate finds shall be recorded three dimensionally. Non–modern artefacts will be collected from the excavated topsoil and subsoil. Finds material will be stored in controlled environments, where appropriate. All artefacts recovered will be retained, cleaned, labelled and stored as detailed in the guidelines laid out in the IFA Guidelines for Finds Work. Any conservation work will be undertaken by approved conservators working to UKIC guidelines.

4.11 Archaeological Services WYAS shall fully record all excavated archaeological contexts by detailed written records giving details of location, composition, shape, dimensions, relationships, finds, samples, and cross-references to other elements of the record and other relevant contexts, in accordance with best practice and in accordance with methods previously approved by the North Yorkshire Heritage Unit. All contexts, and any small finds and samples from them will be given unique numbers. Bulk finds will be collected by context. Colour digital and monochrome negative photographs at a minimum format of 35mm will be taken.

4.12 A soil-sampling programme shall be undertaken during the course of the investigation for the identification and recovery of carbonised and waterlogged remains, vertebrate remains, molluscs and small artefactual material. Environmental and soil specialists will be consulted during the course of the excavation with regard to the implementation of this sampling programme. Provision should be made for the removal of soil samples of between 10 and 30 litres (where appropriate), from deposits with clear potential, and larger samples from any rich carbonised deposits. Particular attention will be paid to the sampling of primary ditch fills and any surviving buried soils beneath banks or other positive features. Environmental material removed from site will be stored in appropriate controlled environments. The collection and processing of environmental samples will be undertaken in accordance with guidelines set out in the Association for Environmental Archaeology's (1995) Working Paper No. 2, "Environmental Archaeology and Archaeological Evaluations - Recommendations concerning the environmental archaeology component of archaeological evaluations in England". In addition, the processing of environmental samples will only take place within facilities approved for such purposes by English Heritage's Regional Science Advisor.

4.13 In the event of human remains being discovered they will be left in situ and covered and protected in the first instance. The removal of human remains will only take place in compliance with the Burial Act 1857 and with an exhumation licence obtained form the Ministry of Justice (MoJ) prior to the removal of the remains. Provision will be made for the specialist reporting of the remains by a recognised osteoarchaeologist.

4.14 Provision will be made for the recovery of samples suitable for scientific dating (e.g. radiocarbon / AMS dating, archaeomagnetic and dendrochronological dating).

4.15 All finds of gold and silver and associated objects shall be reported to HM Coroner according to the procedures relating to the Treasure Act 1997, after discussion with the Environment Agency and the North Yorkshire Heritage Unit.

5. Analysis and Reporting

5.1 The site archive will contain all the data collected during the excavation, including records, finds and environmental samples. It will be quantified, ordered, indexed and internally consistent. Adequate resources will be provided during fieldwork to ensure that all records are checked and internally consistent. Archive consolidation will be undertaken immediately following the conclusion of fieldwork:

- the site record will be checked, cross–referenced and indexed as necessary;
- all retained finds will be cleaned, conserved, marked and packaged in accordance with the requirements of the recipient museum;
- all retained finds will be assessed and recorded using pro forma recording sheets, by suitably qualified and experienced staff. Initial artefact dating will be integrated within the site matrix;
- all retained environmental samples will be processed by suitably experienced and qualified staff and recorded using pro forma recording sheets.

5.2 The archive will be assembled in accordance with the specification set out in English Heritage's *Management of Archaeological Projects* (English Heritage 1991; Appendix 3). In addition to the site records, artefacts, ecofacts and other sample residues, the archive shall contain:

- site matrices where appropriate;
- a summary report synthesising the context record;
- a summary of the artefact record;
- a summary of the environment record.

5.3 The integrity of the primary field record will be preserved. Security copies will be maintained where appropriate.

5.4 Provision will be made for the deposition of the archive, artefacts and environmental material, subject to the permission of the relevant landowner (and if no further archaeological work is to be initiated), in the appropriate recipient museum, in this instance Malton Museum, Old Town Hall, Market Place, Malton. The museum will be advised of the timetable of the proposed investigation prior to excavation commencing. The archive will be prepared in accordance with the guidelines published in "Guidelines for the preparation of Excavation Archives for long–term storage" (United Kingdom Institute for Conservation, 1990) and Standards in the Museum care of archaeological collections (Museums and Galleries Commission 1994). Provision will be made for the stable storage of paper records and their long–term storage.

5.5 Upon completion of the investigations, the artefacts, ecofacts and stratigraphic information shall be assessed as to their potential and significance for further analysis.

5.6 An assessment report will be prepared within an agreed following the completion of on-site archaeological investigations and include the following:

- a non–technical summary of the results of the work;
- a summary of the project's background;
- the site location;
- an account of the method;
- the results of the excavation, including phasing and interpretation of the site sequence and spot–dating of artefacts, if recovered;
- an assessment of the stratigraphic and other written, drawn and photographic records;
- a catalogue of the archaeological material recovered during the excavation
- a summary of the contents of the project archive and its location
- recommendations for any further work.

5.7 The report will be produced within an agreed timetable. It will be supported by an overall plan of the site, accurately identifying the location of the trial excavations.

5.8 Finally, the report will outline the archaeological significance of the deposits identified, and provide an interpretation of the results in relation to other sites in the vicinity.

5.9 Copies of the report will be supplied to the Environment Agency and to the NYCC, who shall also receive a digital copy.

5.10 A final report, including all finds analysis and scientific dating results, shall be produced in accordance with English Heritage's Management of Archaeological Projects (English Heritage 1991).

5.11 Upon completion of the work, the archaeological contractor should make their work accessible to the wider research community by submitting digital data and copies of reports online to OASIS (http://ads.ahds.ac.uk/project/oasis/). Submission of data to OASIS does not discharge the planning requirements for the archaeological contractor to notify the Historic Environment Team, NYCC of the details of the work and to provide the Historic Environment Record (HER) with a report on the work.

5.12 It is possible that the excavation findings will warrant wider publication. This shall be effected either through one of Archaeological Service WYAS's in-house series of publications or through publication with an appropriate archaeological journal.

6. Copyright, Confidentiality and Publicity

6.1 Copyright in the documentation prepared by the archaeological contractor and specialist sub-contractors should be the subject of additional licences in favour of the repository accepting the archive and North Yorkshire County Council to use such documentation for their statutory educational and museum service functions, and to provide copies to third parties as an incidental to such functions.

6.2 Under the Environmental Information Regulations 2005 (EIR), information submitted to the HER becomes publicly accessible, except where disclosure might lead to environmental damage, and reports cannot be embargoed as 'confidential' or 'commercially sensitive'.

6.3 Requests for sensitive information are subject to a public interest test, and if this is met, then the information has to be disclosed. The archaeological contractor should inform the client of EIR requirements, and ensure that any information disclosure issues are resolved before completion of the work. Intellectual property rights are not affected by the EIR.

6.4 Unless the Client commissioning the project wishes to state otherwise, the copyright of any written, graphic or photographic record and reports will rest with the originating body (Archaeological Services WYAS).

7. Health and Safety

7.1 Archaeological Services WYAS has its own Health and Safety policy which has been compiled using national guidelines such as SCAUM. These guidelines conform to all relevant Health and Safety legislation.

7.2 In addition each project undergoes a 'Risk Assessment' which sets project specific Health and Safety requirements to which all members of staff are made aware of prior to on–

site work commencing. Health and safety will take priority over archaeological matters. Necessary precautions will be taken over underground services and overhead lines at the outset of the project.

8. Insurance

8.1 Archaeological Services WYAS is covered by the insurance and indemnities of the City of Wakefield Metropolitan District Council. Insurance has been effected with: Zurich Municipal Insurance, Park House, 57–59 Well Street, Bradford, BD1 5SN (policy number RMP 03GO39–0143). Any further enquiries should be directed to: The Chief Financial Officer, Insurance Section, Wakefield MDC, PO Box 55, Newton Bar, Wakefield WF1 2TT.

9. Monitoring

9.1 Access to the site should be arranged through the commissioning body.

9.2 It is the archaeological contractor's responsibility to ensure that Health and Safety requirements are fulfilled.

9.3 The project will be monitored by the Historic Environment Team, North Yorkshire County Council to whom written documentation should be sent before the start of the work confirming:

- the date of commencement,
- the names of all finds and archaeological science specialists likely to be used in the evaluation, and
- notification to the proposed archive repository of the nature of the works and opportunity to monitor the works.

9.4 Where appropriate, the advice of the Regional Advisor for Archaeological Science (Yorkshire and the Humber Region) at English Heritage will be called upon.

9.5 It is the responsibility of the archaeological contractor to ensure that any significant results are brought to the attention of the Historic Environment Team, North Yorkshire County Council and the commissioning body as soon as is practically possible. This is particularly important where there is any likelihood of contingency arrangements being required.

9.6 It is the archaeological contractor’s responsibility to ensure that monitoring takes place by arranging monitoring points as follows:

- a meeting or discussion prior to the commencement of the work to
- agree in writing the locations of the proposed works.
- progress meeting(s) during the fieldwork phase at appropriate

- points in the work schedule, to be agreed.
- a meeting during the post-fieldwork phase to discuss the draft
- report and archive before completion.

10. Resources and Programming

10.1 Project personnel :

Project Management:	Alistair Webb BA MIfA
Project Supervisor:	TBA

10.2 Post–excavation specialists :

Prehistoric pottery specialists:	Dr Chris Cumberpatch
Roman pottery specialist:	Dr Ruth Leary
Medieval pottery specialist:	Dr Chris Cumberpatch
Flint specialist:	Dr Ian P Brooks
Environmental specialist:	Dr Jane Richardson
Faunal analyst:	Dr Jane Richardson
Human bone specialist:	Malin Holst MA
Metalwork specialist:	Dr Hilary Cool
Artefact conservationist:	Karen Barker

10.3 The list of Archaeological Services WYAS project personnel may be subject to change.

Appendix 2: Magnetic survey: technical information

Magnetic Susceptibility and Soil Magnetism

Iron makes up about 6% of the Earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haemetite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms so that by measuring the magnetic susceptibility of the topsoil, areas where human occupation or settlement has occurred can be identified by virtue of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected. Less magnetic material such as masonry or plastic service pipes that intrude into the topsoil may give a negative magnetic response relative to the background level.

The magnetic susceptibility of a soil can also be enhanced by the application of heat. This effect can lead to the detection of features such as hearths, kilns or areas of burning.

Types of Magnetic Anomaly

In the majority of instances anomalies are termed 'positive'. This means that they have a positive magnetic value relative to the magnetic background on any given site. However some features can manifest themselves as 'negative' anomalies that, conversely, means that the response is negative relative to the mean magnetic background. Such negative anomalies are often very faint and are commonly caused by modern, non-ferrous, features such as plastic water pipes. Infilled natural features may also appear as negative anomalies on some geological substrates.

Where it is not possible to give a probable cause of an observed anomaly a '?' is appended.

It should be noted that anomalies interpreted as modern in origin might be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can therefore remove the feature causing the anomaly.

The types of response mentioned above can be divided into five main categories that are used in the graphical interpretation of the magnetic data:

Isolated dipolar anomalies (iron spikes)

These responses are typically caused by ferrous material either on the surface or in the topsoil. They cause a rapid variation in the magnetic response giving a characteristic 'spiky' trace. Although ferrous archaeological artefacts could produce this type of response, unless there is supporting evidence for an archaeological interpretation, little emphasis is normally given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring.

Areas of magnetic disturbance

These responses can have several causes often being associated with burnt material, such as slag waste or brick rubble or other strongly magnetised/fired material. Ferrous structures such as pylons, mesh or barbed wire fencing and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

Linear trend

This is usually a weak or broad linear anomaly of unknown cause or date. An agricultural origin, either ploughing or land drains is a common cause.

Areas of magnetic enhancement/positive isolated anomalies

Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response (sometimes only visible on an XY trace plot) on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

Linear and curvilinear anomalies

Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

Methodology: Magnetic Susceptibility Survey

There are two methods of measuring the magnetic susceptibility of a soil sample. The first involves the measurement of a given volume of soil, which will include any air and moisture that lies within the sample, and is termed volume specific susceptibility. This method results in a bulk value that it not necessarily fully representative of the constituent components of the

sample. The second technique overcomes this potential problem by taking into account both the volume and mass of a sample and is termed mass specific susceptibility. However, mass specific readings cannot be taken in the field where the bulk properties of a soil are usually unknown and so volume specific readings must be taken. Whilst these values are not fully representative they do allow general comparisons across a site and give a broad indication of susceptibility changes. This is usually enough to assess the susceptibility of a site and evaluate whether enhancement has occurred.

Methodology: Gradiometer Survey

There are two main methods of using the fluxgate gradiometer for commercial evaluations. The first of these is referred to as ***magnetic scanning*** and requires the operator to visually identify anomalous responses on the instrument display panel whilst covering the site in widely spaced traverses, typically 10m apart. The instrument logger is not used and there is therefore no data collection. Once anomalous responses are identified they are marked in the field with bamboo canes and approximately located on a base plan. This method is usually employed as a means of selecting areas for detailed survey when only a percentage sample of the whole site is to be subject to detailed survey.

The disadvantages of magnetic scanning are that features that produce weak anomalies (less than 2nT) are unlikely to stand out from the magnetic background and so will be difficult to detect. The coarse sampling interval means that discrete features or linear features that are parallel or broadly oblique to the direction of traverse may not be detected. If linear features are suspected in a site then the traverse direction should be perpendicular (or as close as is possible within the physical constraints of the site) to the orientation of the suspected features. The possible drawbacks mentioned above mean that a 'negative' scanning result should be validated by sample detailed magnetic survey (see below).

The second method is referred to as ***detailed survey*** and employs the use of a sample trigger to automatically take readings at predetermined points, typically at 0.25m intervals, on zig-zag traverses 1m apart. These readings are stored in the memory of the instrument and are later dumped to computer for processing and interpretation. Detailed survey allows the visualisation of weaker anomalies that may not have been detected by magnetic scanning.

During this survey a Bartington Grad601 magnetic gradiometer was used taking readings on the 0.1nT range, at 0.25m intervals on zig-zag traverses 1m apart within 30m by 30m square grids. The instrument was checked for electronic and mechanical drift at a common point and calibrated as necessary. The drift from zero was not logged.

Data Processing and Presentation

The detailed gradiometer data has been presented in this report in XY trace and greyscale formats. In the former format the data shown is 'raw' with no processing other than grid biasing having been done. The data in the greyscale images has been interpolated and

selectively filtered to remove the effects of drift in instrument calibration and other artificial data constructs and to maximise the clarity and interpretability of the archaeological anomalies.

An XY plot presents the data logged on each traverse as a single line with each successive traverse incremented on the Y-axis to produce a ‘stacked’ plot. A hidden line algorithm has been employed to block out lines behind major ‘spikes’ and the data has been clipped. The main advantage of this display option is that the full range of data can be viewed, dependent on the clip, so that the ‘shape’ of individual anomalies can be discerned and potentially archaeological anomalies differentiated from ‘iron spikes’. Geoplot 3 software was used to create the XY trace plots.

Geoplot 3 software was used to interpolate the data so that 3600 readings were obtained for each 30m by 30m grid. The same program was used to produce the greyscale images. All greyscale plots are displayed using a linear incremental scale.

Appendix 3: Survey location information

The site grid was laid out using a Geodimeter 600s total station theodolite and tied in to the corners of buildings and other permanent landscape features and to temporary reference points (survey marker stakes) that were established and left in place following completion of the fieldwork for accurate geo-referencing. The locations of the temporary reference points are shown on Figure 2 and the Ordnance Survey grid co-ordinates tabulated below. The internal accuracy of the survey grid relative to these markers is better than 0.05m. The survey grids were then superimposed onto a map base provided by the client as a 'best fit' to produce the displayed block locations. Overall there was a good correlation between the local survey and the digital map base and it is estimated that the average 'best fit' error is better than ±1.5m. However, it should be noted that Ordnance Survey co-ordinates for 1:2500 map data have an error of ±1.9m at 95% confidence. This potential error must be considered if co-ordinates are measured off for relocation purposes.

Station	**Easting**	**Northing**
A	427797.4	472540.3
B	427833.1	472557.5
C	427612.2	472553.4

Archaeological Services WYAS cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party or for the removal of any of the survey reference points.

Appendix 4: Geophysical archive

The geophysical archive comprises:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Microsoft Word 2000), and graphics files (Adobe Illustrator CS2 and AutoCAD 2007) files.
- a full copy of the report

At present the archive is held by Archaeological Services WYAS although it is anticipated that it may eventually be lodged with the Archaeology Data Service (ADS). Brief details may also be forwarded for inclusion on the English Heritage Geophysical Survey Database after the contents of the report are deemed to be in the public domain (i.e. available for consultation in the relevant Sites and Monument Record Office).

Appendix 5: Inventory of primary archive

Phase	File/Box No	Description	Quantity
Evaluation	File no.1	Context register sheets	3
		Drawing sheet register	1
		Drawing register	2
		Levels sheets	28
		Sample register sheets	1
		Trench sheets	77
		Photo register sheets	18
		Film ID sheets	11
		Digital photograph record sheets	9
		Colour negative strips	
		B&W negative strips	
		Daily site recording form	
		Small drawing sheets	9
		Context sheets	55

Appendix 6: Concordance of contexts

Context	Trench	Description	Artefacts and environmental samples
100	7	Dark grey brown silty clay, topsoil	
101	7	Mid-reddish brown silty clay, subsoil	
102	7	Dark reddish brown silty clay, single fill of gully 103	GBA 1
103	7	Cut of linear gully	
104	7	Light yellowish brown clay and stone, natural	
105	4	Dark greyish brown silty clay, topsoil	
106		Void	
107	4	Blackish brown silty clay and stones, secondary fill of ditch 109	GBA 2
108	4	Dark reddish brown silty clay and stones, primary fill of ditch 109	
109	4	Cut of ditch	
110	4	Dark reddish brown mottled orange clay, natural	
111	45	Mid- greyish brown silty clay, topsoil	
112	45	Mid to dark greyish brown silt, fill of field drain 113	
113	45	Cut of field drain	
114	45	Light to mid-orangey/yellowish brown sandy clay, natural	
115	45	Mid-mottled greyish/orangey brown silty clay, fill of land drain 116	
116	45	Cut of field drain	
117	41	Mid-greyish brown silty clay, topsoil	
118	41	Mid-greyish brown silt, fill of land drain 119	
119	41	Cut of field drain	
120	41	Mid-orangey/yellowish brown sandy clay, natural	
121	29	Mid-greyish brown silty clay, topsoil	
122	29	Mid-orangey brown sandy silt, fill of ditch 123	GBA 3
123	29	Cut of linear ditch	
124	29	Mid-orangey/yellowish brown sandy clay, natural	
125	28	Dark greyish brown silty clay, topsoil	
126	28	Mid-brownish grey silty clay, primary fill of ditch 127	GBA 6 and 1 fragment of horse shoe
127	28	Cut of linear ditch	
128	28	Mid-orangey brown sandy clay, natural	
129	34	Mid-greyish brown clayey silt, topsoil	
130	34	Mid-orangey brown sandy clayey silt, subsoil	
131	34	Light yellowish brown clayey silt and	GBA 4

		charcoal, single fill of post-hole	
132	34	Cut of post-hole	
133	34	Light yellowish brown sandy silt, backfill of post-hole 135	
134	34	Mid-yellowish brown sandy silty clay and charcoal, fill of post-hole 135	GBA 5
135	34	Cut of post-hole	
136	34	Mid to light orangey brown sandy clay and gravel, natural	
137	28	Mid-orangey brown silty sand, secondary fill of ditch 127	
138	68	Mid-orangey greyish brown sandy silt, fill of land drain	
139	68	Cut of land drain	
140	9	Mid-greyish brown clayey silt, topsoil	
141	9	Mid-orangey brown sandy silt, subsoil	
142	9	Dark orangey brown clayey/sandy silt and stones, single fill of ditch 143	GBA 7
144	9	Cut of linear ditch	
145	9	Same as 142	GBA 8
146	9	Mid-yellowish brown sandy clay and gravel, natural	
147	51	Mid-greyish brown sandy silt, topsoil	
148	51	Mid-orangey brown sandy silt, subsoil	
149	51	Mid-greyish brown silty sand, silting up of palaeochannel 150	
150	51	Cut of possible palaeochannel	
151	51	Light brown clayey sand and gravel, natural	
152	68	Mid-greyish brown sandy silt, topsoil	
153	68	Light yellowish/greyish brown silty sand and gravel, natural	
154	60	Mid-to dark orangey brown sandy silt and clay, possible palaeochannel	
155	60	Cut of possible palaeochannel	

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