Land South-East of Williamsport Way
Lion Barn Industrial Estate
Needham Market
(Barking Parish)
Suffolk
BRK 125

Archaeological Evaluation Report

SCCAS Report No. 2012/046

Client: David Clarke & Associates Building Design Consultants Ltd

Author: Jezz Meredith

September 2012

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Author: Jezz Meredith

Contribution by: Richenda Goffin

Illustrator: Gemma Adams

Editor: Richenda Goffin

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HER Information

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Prepared By: Jezz Meredith
Date: September 2012

Approved By: Dr Rhodri Gardner
Position: Acting Contracts Manager
Date:
Signed:

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Summary

An area of 2.42 hectares was evaluated by trial trenching to provide a 5% sample of the site. Despite the area being within a presumed area of raised gravel terrace above the River Gipping, undisturbed natural sand and gravel was encountered only at the extreme northern and western edges of the site. Over the rest of the site alluvial floodplain deposits of clay and silty clay were found sealing organic peats and waterlogged deposits of up to 1m depth.

Analysis by Birmingham University's Archaeo-Environmental team has shown that the waterlogged deposits had previously dried out and the peats had become desiccated and oxidised. This had resulted in the environmental samples being of limited value. The samples however could be radiocarbon dated and analysed for pollen. The peat deposit started to grow within a blocked-off river channel from the Early Bronze Age and indicated that a managed landscape of pasture was in the vicinity. The silty clay horizon over the peat was of Roman date and was associated with arable farming and the growing of barley. The end of the organic sequence was dated to the medieval period.

An iron horseshoe of probable late medieval or post-medieval date was recovered from the alluvial clay layer sealing the peat deposits. As this layer is of probable Roman date this suggests that the horseshoe is likely to be an intrusive find. No other features or finds of archaeological significance were identified from this site.

A large artificial channel of up to 15m width was encountered curving into the southern edge of the site. As this feature aligns with a culvert running under the railway embankment adjacent to the site, it is presumed that this ditch is contemporary with the railway which opened in 1846. Drainage of this area for the construction of the railway probably accounted for the drying out of the peat deposits in the 19th century.

Some areas along the western edge of the site could not be trenched because more than 2m of material had been dumped here to raise the ground surface or to store soil. Topsoil had been stripped off most areas of the site and vegetation had been removed. Standing water was found over much of the central part of the site. Many of the trenches quickly filled with water, particularly as the trenching was conducted during a period of heavy rainfall.

1. Introduction

This is an interim report; an updated version will be produced when a full palaeoenvironmental statement is ready for inclusion.

A trial trench evaluation was carried out on land to the south-east of Williamsport Way, Lion Barn Industrial Estate, Needham Market (Fig. 1; grid reference TM 0997 5405). The proposed development area (hereafter referred to as 'the site') consisted of an area of c.2.42 hectares and trenching was undertaken to investigate a 5% sample of the site.

The evaluation was in advance of planning permission being sought from Mid Suffolk District Council for a proposed business park development. A Brief and Specification issued by Jess Tipper (Appendix 1) outlined the manner of the fieldwork and a Written Scheme of Investigation (WSI) detailed the archaeological methodology and risk assessment (Meredith 2012).

The Brief and Specification also required a geophysical survey of the development area and these results are provided in Appendix 3 (Biggs 2012). The site was investigated by gradiometry survey. This indicated that a possible linear feature curved across the southern end of the site.

The trial trenching was conducted by the Field Team of the Suffolk County Council Archaeological Service (SCCAS), between the 6th and the 8th of March 2012.

Waterlogged and peat deposits encountered during trial trenching were further examined by the Archaeo-Environmental team of Birmingham University on the 14th March 2012. The results are not included in this interim report but will be included as an extra appendix at a future date.

The site lies within an area of expansion of Needham Market which historically was associated with Barking parish. It is for this reason that the site has been given a Barking reference (BRK 125) with the Suffolk Historic Environment Record (HER).

Plate 1. View of site looking east showing waterlogged trenches and wet conditions

2. Geology and topography

According to the British Geological Survey (2006), the site is located on river terrace deposits (sand and gravel). Nearby alluvium deposits (sandy silty clay), associated with the floodplain of the River Gipping, might extend into the area of the site.

The site lies within an area of rolling valley farmlands, according to Suffolk Suffolk County Council's *Suffolk Landscape Character Assessment* (www.suffolklandscape.org.uk). This is an area of gentle valley sides with some complex and steep slopes, deep well-drained loamy soils, an organic pattern of fields smaller than on the plateaux and distinct areas of regular field patterns.

The site is relatively level and appears low lying with the industrial estate areas to the north and west on raised, built-up ground, the railway along the north-eastern edge of the site on top of a high embankment and Gallows Hill rising to the south. Most of the site lies on or just above 16m AOD, with the ground rising up quite steeply just before reaching the B1113, which forms the south-western edge of the site, with an approximate height of 20m AOD.

3. Archaeology and historical background

The site is located close to a number of significant archaeological features and findspots spread along this historically important stretch of the River Gipping valley (Fig. 1, B).

Immediately to the north-west and north of the site are two possible ring-ditches (BRK 099 and 100), indicating the presence of possible prehistoric burial mounds. These features were detected from aerial photographs. Unfortunately Lion Barn industrial estate was built over these sites before their presence was recognised. The possible ring-ditch BRK 100 was investigated by trenching when the warehouse to the north was extended (Meredith 2008). Recent deposits of over 2m thickness made the recognition of archaeological features difficult to detect at this depth.

At 600m to the north-east on the other side of the river, is the possible Roman villa at Riverside Farm (CRM 003). Although at some distance from the site, a prestigious Roman complex such as this might have had considerable influence along and on either side of the valley. To the south-east, starting at a distance of c.350m from the evaluation, was the large multi-period site of Gallows Hill (BRK 104; Boulter 2002). Within this fourteen hectare site, all periods were represented from the Mesolithic to the post-medieval. Of particular significance was a Roman road or trackway and a number of sunken featured buildings of Early Anglo-Saxon date. A scatter of Roman pottery was found 400m to the south of the present site at BRK 023 and at 550m from the site to the south was a scatter of Iron Age pottery (BRK 013). Both these HER entries indicate likely settlement belonging to these periods.

In more recent times the area has been considerably modified by the building of the railway in 1846, the high embankment of which forms the north-eastern boundary of the site. In the 19th century the railway replaced river transport as the main means of haulage; but this was replaced in turn during the 20th century by the routing of a major road system along the Gipping corridor. Improved transport routes have resulted in an expansion of the town of Needham Market. This means that the area of the site, historically part of Barking (and thus given the HER reference BRK 125), will be incorporated into a business park originating in Needham Market.

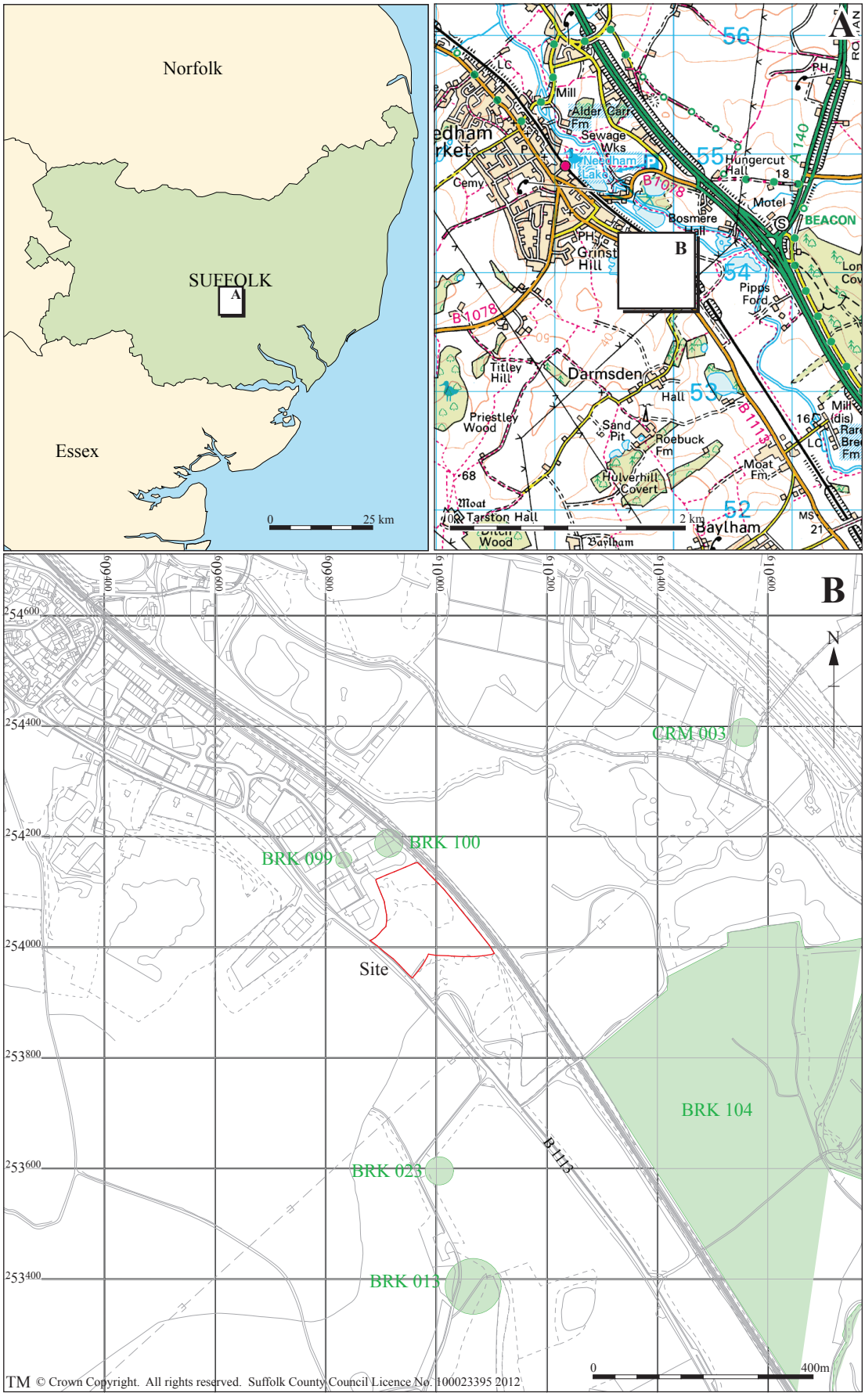

Figure 1. Location of site, showing Historic Environment Record entries as mentioned in the text.

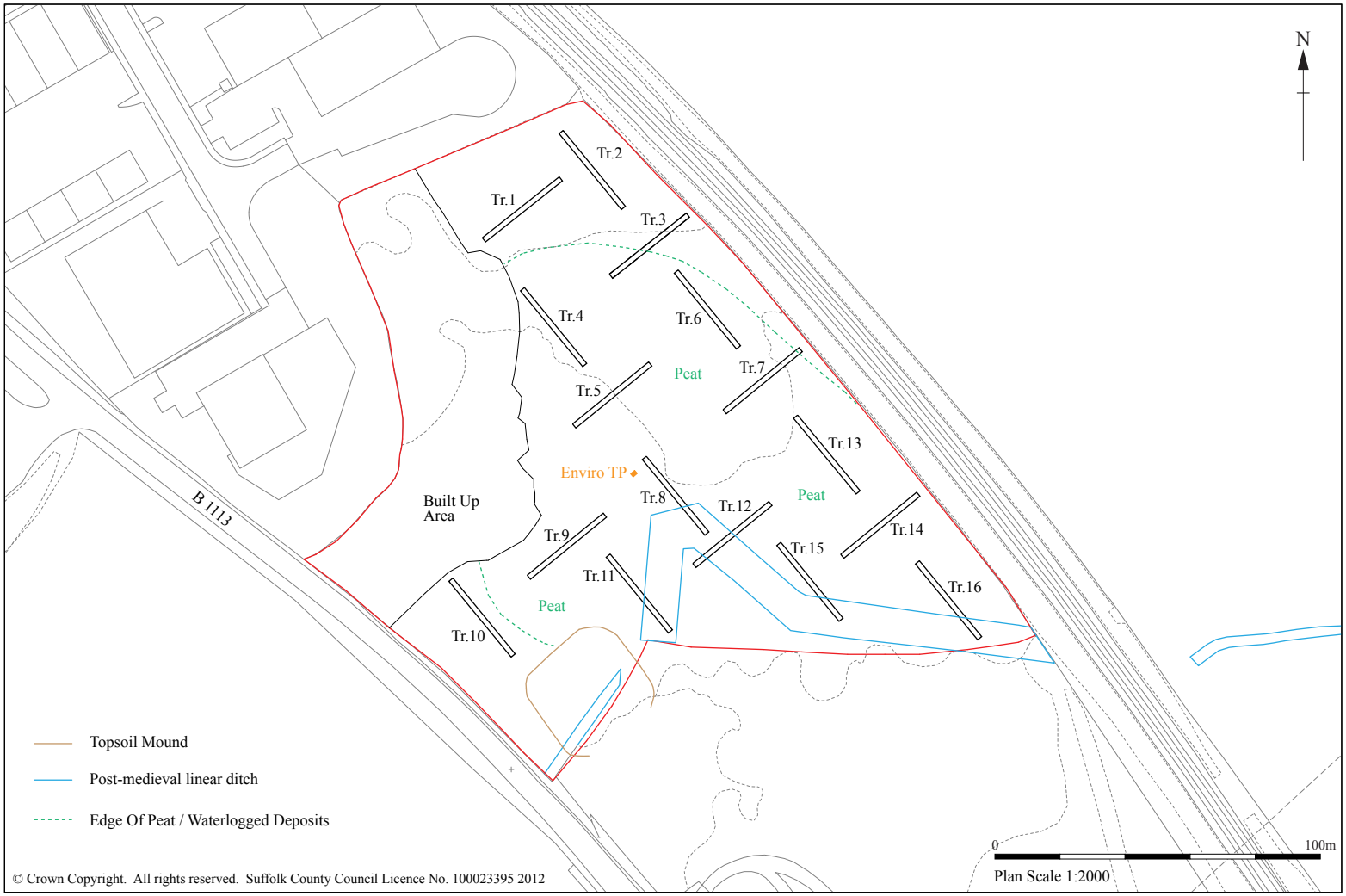

Figure 2. Trench locations and Environmental Test Pit

4. Methodology

Trenching was conducted using a tracked 360° mechanical digger equipped with a 1.8m wide toothless ditching bucket. Sixteen trenches were positioned to sample the proposed area of development (Fig. 2). Another five trenches proposed along the western edge of the site could not be cut due to the presence of deep built-up areas and a large mound of topsoil. Prior to the trenching of the site the area had been cleared of all vegetation and the topsoil had, in most places, been stripped off.

Large areas of standing water were encountered across the central area of the site. The trenching was conducted during a period of high rainfall so that this resulted (along with the high level of ground water) in the base of most trenches filling with water.

The trenches had been laid out using GPS (Global Positioning System) survey equipment. The trench plan was devised to sample unknown areas of the site and to investigate possible geophysical survey anomalies (Meredith 2012; Appendix 4, Biggs 2012).

All machining was observed by an archaeologist standing adjacent to or within the trench. Overburden deposits (mainly alluvium and colluvium) were removed by machine to reveal either undisturbed natural deposits of sand and gravel or waterlogged peat deposits. In trenches where peat was encountered a machined test hole was dug to measure the thickness of peat before the hole filled with water. In most cases, where the trenches were deep, the test hole was promptly backfilled to avoid collapse and potential risk to staff.

The base of each trench was examined for features or finds of archaeological interest. Peat deposits (if the trenches were dry) were checked for metallic finds with a metal detector. The upcast soil was examined visually for any archaeological finds. Records were made of the position and length of trenches and the depths of deposit encountered.

Artificial, colluvial and alluvial deposits and the natural stratum (hereafter referred to as ‘the natural’) were recorded using a unique sequence of context numbers in the range

0001–0073 (Appendix 2). Specimen sections from each trench were drawn at a scale of 1:20 on sheets of gridded drawing film.

Due to the poor weather conditions during the project, written descriptions were made on the drawing film alongside the section drawings rather than on *pro forma* context recording sheets. A digital photographic record was made of each trench and section, consisting of high-resolution .jpg images.

The waterlogged alluvial and peat deposits were sampled by Birmingham University for detailed environmental analysis and for radiocarbon dating. An environmental test pit was dug by machine down to the top level of the peat after which a small hand-dug test hole was made through the waterlogged deposits. Controlled samples were taken from the side of this pit while water was baled out to reveal the deposits.

The site has been given the Suffolk Historic Environment Record (HER) code BRK 125; although the site is within the modern boundaries of Needham Market this area historically belonged to the parish of Barking. The site has been given a Barking HER code as all other archaeological sites in the vicinity (e.g. BRK 100 to the north) are recorded as being part of Barking. All elements of the site archive are identified with this code.

An OASIS record (for the Archaeological Data Service) has been initiated and the reference code suffolkc1-122567 has been used for this project.

5. Results

Sixteen trenches were excavated across the site (Fig. 2). The details of each trench will be summarised below. The deposits described are from sections drawn from the middle point of each trench unless otherwise stated.

Trench 1

This trench which was located near the northern end of the site, was orientated north-east to south-west and was 25m in length. Table 1 gives information on the nature and thickness of deposits encountered.

Height, top of trench (Above Ordnance Datum)	16.2m AOD	Depth	Context
Layers	(No topsoil)		
	Clay: mid reddish brown firm silty clay with very occasional small & medium sub-angular flints (alluvium)	0.10m	0007
	Clay: dark blue grey firm silty clay, no inclusions (alluvium)	0.14m	0008
	Sand: dark blue grey loose silty sand with moderate small & medium sub-angular & sub-rounded flints (alluvium?)	0.22m	0009
	Natural: mottled yellow and yellow brown sand & gravel		0003

Table 1. Trench 1 deposits and details

Trench 1 was one of the few trenches that revealed undisturbed yellow natural without uncovering peat deposits. The clay and silty sand deposits above natural are likely to have been of alluvial origin and were thus likely to be close to the edge of waterlogged deposits nearby.

Trench 2

Trench 2 was located near the northern end of the site, east of Trench 1. This trench was aligned north-west to south-east and was 34m in length. Like Trench 1, no peat deposits were encountered here but the dark clay – and probably also the dark silty sand – layers are likely to have been laid down by water. Clean, yellow natural was encountered here, but the occasional darker mottles might have been caused by water action. Table 2 itemises details of the trench:

Height, top of trench (Above Ordnance Datum)	16.3m AOD	Depth	Context
Layers	(No topsoil)		
	Clay: dark brown grey firm silty clay with moderate small to medium small to medium sub-angular & sub-rounded flints (alluvium)	0.10m	0010
	Sand: dark grey brown loose silty sand with occasional medium sub-angular & sub-rounded flints & moderate small flints (alluvium?)	0.14m	0011
	Natural: mottled yellow and yellow brown sand & gravel		0003

Table 2. Trench 2 deposits and details

Trench 3

Trench 3 was located towards the north of the site, south of Trench 2 and close to the north-east edge of the site. This trench was orientated north-east to south-west and was 30m in length. Although much of the base of this trench revealed clean natural of yellow sand and gravel, peat was encountered towards the south-western end of the trench. Deposits 0014 and 0015 observed mid way along the trench (see Table 2) are probably the first damp to wet deposits observed before the extensive peat and waterlogged layers were encountered in the trenches to the south of Trench 3.

Height, top of trench (Above Ordnance Datum)	16.0m AOD	Depth	Context
Layers	(No topsoil)		
	Clay: dark brown grey firm silty clay with moderate small to medium small to medium sub-angular & sub-rounded flints (alluvium)	0.08m	0012
	Clay: dark blue grey firm silty clay, no inclusions (alluvium)	0.14m	0013
	Sand: dark grey/black loose silty sand with small sub-angular flints (alluvium)	0.16m	0014
	Sand: very black loose silty sand with frequent small & medium sub-rounded to sub-angular flints (alluvium)	0.30m	0015
	Natural: mottled yellow and yellow brown sand & gravel		0003

Table 3. Trench 3 deposits and details

Trench 4

Trench 4 was positioned near the northern end of the site to the south of Trench 1 and to the West of Trench 3. This trench was orientated north-west to south-east and was 26.5m in length. Various clay layers of probable alluvial origin overlay a deep peaty deposit of c.0.7m thickness (0019). As the machine test hole filled quickly with water only an estimated depth could be recorded. An iron horse shoe (of possible medieval or later date) was recovered as a metal detector find from clay layer 0017.

Height, top of trench (Above Ordnance Datum)	16.0m AOD	Depth	Context
Layers	(No topsoil)		
	Clay: dark brown firm silty clay with occasional pieces of chalk (alluvium)	0.22m	0016
	Clay: mid grey brown silty clay, *horse shoe find*, (alluvium)	0.22m	0017
	Clay: dark blue grey firm silty clay, no inclusions (alluvium)	0.14m	0018
	Peat: dark brown black peaty deposit containing organic material	c.0.70m	0019
	Natural: pale grey sand & gravel, water washed natural		0071

Table 4. Trench 4 deposits and details

Trench 5

Trench 5 was positioned centrally to the site and was south of Trench 4. This trench was orientated north-east to south-west and was 30m in length. During machine excavation the deposits encountered were poorly understood with the clean yellow sandy layer 0021 mistook for natural. It is quite likely that these natural-like deposits are either of hillwash (colluvium) origin or are artificial spreads created to raise the level of the site in the past.

At the south-western end a machine test hole was dug through these deposits to reveal the peat layer underneath. The deposits listed in Table 5 are from the south-western end of the trench.

Height, top of trench (Above Ordnance Datum)	16.7m AOD	Depth	Context
Layers	Topsoil: probably truncated	0.18m	0002
	Sand: mid reddish brown loose silty sand with occasional small flints (colluvium?)	0.32m	0020
	Sand: light yellow loose sand with occasional small stones (colluvium?)	0.24m	0021
	Clay: mid grey brown silty clay on top but lower clay elements not differentiated, (alluvium)	0.48m	0065
	Peat: dark brown black peaty deposit containing organic material	0.65m	0066
	Natural: pale grey sand & gravel, water washed natural		0071

Table 5. Trench 5 deposits and details

Trench 6

Trench 6 was positioned along the north-eastern edge of the site, to the east of Trench 5 and south of Trench 3. This trench was orientated north-west to south-east and was 30.5m long. The trench was located in a very wet part of the site with standing water accumulating over the top of deposits. It was difficult to bottom deposits due to the level of waterlogging so that the section (Table 6) could only be recorded to a depth of c.0.5m which was just within the top of the peat layer 0025. Due to the very wet nature of this trench, the section had to be recorded at the south-eastern end of the trench.

Height, top of trench (Above Ordnance Datum)	15.8m AOD	Depth	Context
Layers	(No topsoil)		
	Clay: light creamy grey brown firm silty clay	0.06m	0022
	Clay: mid grey brown silty clay, (alluvium)	0.26m	0023
	Clay: dark blue grey firm silty clay, no inclusions (alluvium)	0.14m	0024
	Peat: dark brown black peaty deposit containing organic material (not bottomed)	n/a	0025

Table 6. Trench 6 deposits and details

Trench 7 (Plate 2)

Trench 7 was positioned along the north-eastern edge of the site, to the south of Trench 6. This trench was orientated north-east to south-west and was 29.4m in length. Natural deposits (0003) were encountered at the north-eastern end of the trench (where the section below was recorded, see Table 7). Further along the trench waterlogged deposits were encountered, with water-washed natural (0071) revealed at the south-west end of the trench at a depth of c.1.2m.

Height, top of trench (Above Ordnance Datum)	16.2m AOD	Depth	Context
Layers	Topsoil (truncated)	0.10m	0002
	Clay: mid brown streaked grey firm silty clay (alluvium)	0.40m	0026
	Sand: dark grey black loose silty sand with occasional small and medium sub-angular flints (alluvium)	0.25m	0027
	Sand: dark black loose silty sand with occasional small to medium rounded flints, merges with 0027 above (alluvium)	0.20m	0028
	Natural: mottled yellow and yellow brown sand & gravel	n/a	0003

Table 7. Trench 7 deposits and details

Plate 2. Soil profile in Trench 7

Trench 8

Trench 8 was positioned near the centre of the site, to the south of Trench 5. This trench was orientated north-west to south-east and was 31m in length. The deposits encountered in the centre of the trench are listed below in Table 8. Deposits above the clays and peats of alluvial origin could be hill-wash colluvium. A machine dug test hole cut at the north-west end of the trench encountered peat at a depth of c.1.1m and natural at a depth of c.1.8m.

At the south-eastern end of this trench a large drainage ditch or channel 0072 was encountered, which was also revealed in Trenches 11, 12, 15 and 16. The final 10m of the south-eastern end of this trench consisted entirely of fill deposits associated with this feature. Fragments of brick and/or other CBM were observed in the fill of this feature but were lost when this trench flooded.

Height, top of trench (Above Ordnance Datum)	16.2m AOD	Depth	Context
Layers	Topsoil (truncated)	0.10m	0002
	Silt: dark red brown loose sandy silt with occasional small sub-angular flints (colluvium?)	0.38m	0029
	Sand: light yellow grey loose sand (colluvium?)	0.12m	0030
	Clay: mid grey brown silty clay (alluvium)	0.40m	0031
	Clay: dark blue grey firm silty clay, no inclusions (alluvium)	0.20m	0032
	Peat: dark brown black peaty deposit containing organic material (not bottomed)	n/a	0033

Table 8. Trench 8 deposits and details

Trench 9

Trench 9 was positioned near the south-west edge of the site, to the west of Trench 8. This trench was orientated south-west to north-east and was 35m in length. The complex series of deposits encountered were recorded at either end of the trench with those from the north-eastern end recorded in Table 9 and those from the south-western end recorded in Table 10. Deep layers of sandy silts, of possible colluvial origin, masked the alluvium and peat deposits.

Height, top of trench (Above Ordnance Datum)	16.9m AOD	Depth	Context
Layers	Topsoil (truncated)	0.10m	0002
	Silt: dark grey brown loose sandy silt with moderate small flints	0.40m	0034
	Silt: dark red brown sandy silt with moderate small & medium sub-angular flints (colluvium)	0.40m	0035
	Clay: mid grey brown silty clay (alluvium)	0.35m	0036
	Clay: dark blue grey firm silty clay, no inclusions (alluvium)	0.35m	0037
	Peat: dark brown black peaty deposit containing organic material	0.20m	0038
	Peat: similar to 0038 but darker and less organic matter	0.50m	0039
	Natural: pale grey sand & gravel, water washed natural	n/a	0071

Table 9. Trench 9 deposits and details from the north-eastern end of the trench

Height, top of trench (Above Ordnance Datum)	17.3m AOD	Depth	Context
Layers	Topsoil (truncated)	0.10m	0002
	Silt: dark grey brown loose sandy silt with moderate small flints	0.50m	0034
	Silt: dark red brown sandy silt with moderate small & medium sub-angular flints (colluvium)	0.10m	0035
	Silt: mid to dark grey sandy silt with occasional small flints (colluvium)	0.32m	0040
	Sand: light yellow loose sand (colluvium)	0.20m	0041
	Clay: dark blue grey firm silty clay, no inclusions (alluvium)	0.12m	0037
	Peat: dark brown black peaty deposit containing organic material	0.16m	0038
	Clay: dark black / grey firm silty clay	0.08m	0042
	Peat: similar to 0038 but darker and less organic matter	0.22m	0039
	Clay: dark grey firm silty clay	0.06	0043
	Natural: pale grey sand & gravel, water washed natural	n/a	0071

Table 10. Trench 9 deposits and details from the south-western end of the trench

Trench 10

Trench 10 was positioned along the south-western edge of the site, to the west of Trench 9. This trench was orientated north-west to south-east and was 29.8m in length. Alluvial and peat deposits did not extend as far westwards as this trench. The deposits encountered are summarised in Table 11 and include colluvium layers.

Height, top of trench (Above Ordnance Datum)	17.4m AOD	Depth	Context
Layers	Topsoil (truncated)	0.10m	0002
	Silt: dark grey brown loose sandy silt with moderate small flints	0.50m	0044
	Silt: mid red brown loose sandy silt with occasional small sub-angular flints & medium rounded flints (colluvium)	0.10m	0045
	Silt: mid to dark grey sandy silt with occasional small flints (colluvium)	0.32m	0046
	Natural: mottled yellow and yellow brown sand & gravel	n/a	0003

Table 11. Trench 10 deposits and details

Trench 11

Trench 11 was positioned along the southern edge of the site, to the south of Trench 9. This trench was orientated north-west to south-east and was 30m in length. The large drainage channel 0072 was encountered mid trench and was c.12m in width. The deposits described in Table 12 were examined at the south-eastern end of the trench, away from any possible disturbance caused by 0072.

Height, top of trench (Above Ordnance Datum)	17.3m AOD	Depth	Context
Layers	(No topsoil)		
	Silt: dark grey brown loose sandy silt with moderate small flints	0.42m	0047
	Sand: light yellow loose sand	0.16m	0048
	Clay: mid brown firm silty clay with moderate small & medium flints, occasional larger nodules	0.40m	0049
	Clay: dark blue grey firm silty clay, no inclusions (alluvium)	0.16m	0050
	Clay: light grey silty clay mixed with medium sub-angular flint gravel	0.08m	0051
	Peat: dark brown black peaty deposit containing organic material	0.98m	0052
	Natural: pale grey sand & gravel, water washed natural	n/a	0071

Table 12. Trench 11 deposits and details

Trench 12

Trench 12 was positioned near the southern edge of the site, to the south of Trench 8. This trench was orientated north-east to south-west and was 28.2m in length. The large drainage channel 0072 occupied the south-western half of the trench, its deposits extending for c.15m. The layers encountered at the north-eastern end (away from ditch 0072) are recorded in Table 13.

Height, top of trench (Above Ordnance Datum)	16.3m AOD	Depth	Context
Layers	Topsoil (truncated)	0.10m	
	Clay: mid brown firm silty clay with moderate small & medium flints, occasional larger nodules	0.42m	0053
	Clay: mid grey brown silty clay (alluvium)	0.36m	0054
	Clay: dark blue grey firm silty clay, no inclusions (alluvium)	0.08m	0055
	Peat: dark brown black peaty deposit containing organic material	0.32m	0056
	Natural: pale grey sand & gravel, water washed natural	n/a	0071

Table 13. Trench 12 deposits and details

Trench 13

Trench 13 was positioned along the north-eastern edge of the site towards the south-eastern corner, to the south of Trench 7. This trench was orientated north-west to south-east and was 30m in length. The deposits from the south-east end of the trench are recorded in Table 14.

Height, top of trench (Above Ordnance Datum)	16.2m AOD	Depth	Context
Layers	(No topsoil)		
	Clay: blue-grey firm silty clay	0.40m	0057
	Peat: dark brown black peaty deposit containing organic material with moderate gravel throughout	0.42m	0058
	Natural: pale grey sand & gravel, water washed natural	n/a	0071

Table 14. Trench 13 deposits and details

Trench 14

Trench 14 was positioned near the south-eastern corner of the site, to the south of Trench 13. This trench was orientated north-east to south-west and was 28.8m in length. The deposits from the south-west end of the trench are described in Table 15.

Height, top of trench (Above Ordnance Datum)	16.3m AOD	Depth	Context
Layers	Topsoil (truncated)	0.10m	0002
	Clay: blue-grey firm silty clay	0.40m	0059
	Peat: dark brown black peaty deposit containing organic material with moderate gravel throughout	0.42m	0060
	Natural: pale grey sand & gravel, water washed natural	n/a	0071

Table 15. Trench 14 deposits and details

Trench 15

Trench 15 was positioned near the south-eastern corner of the site, to the west of Trench 14. This trench was orientated north-west to south-east and was 30m in length. The deposits from the north-west end of the trench are described in Table 16, apart from the large post-medieval linear feature 0072 which occupied c.8m of the south-eastern end of the trench.

Height, top of trench (Above Ordnance Datum)	16.4m AOD	Depth	Context
Layers	Topsoil (truncated)	0.06m	0002
	Clay: mid brown firm silty clay with moderate small & medium flints, occasional larger nodules	0.54m	0061
	Clay: mid grey brown silty clay (alluvium)	0.30m	0062
	Clay: dark blue grey firm silty clay, no inclusions (alluvium)	0.20m	0063
	Peat: dark brown black peaty deposit containing organic material (not bottomed)	n/a	0064

Table 16. Trench 15 deposits and details

Trench 16

Trench 16 was positioned in the south-eastern corner of the site, to the south of Trench 14. This trench was orientated north-west to south-east and was 27m in length. The deposits from the north-west end of the trench are described in Table 16, apart from the large post-medieval linear feature 0072 which ran across the south-eastern end of the trench, from where it appeared to line up with a culvert running under the railway lines.

Height, top of trench (Above Ordnance Datum)	16.2m AOD	Depth	Context
Layers	Topsoil (truncated)	0.06m	0002
	Clay: dark grey brown firm/crumbly silty clay with moderate small chalk particles & occasional small flints	0.36m	0067
	Clay: mid grey brown silty clay (alluvium)	0.30m	0068
	Clay: dark blue grey firm silty clay, no inclusions (alluvium)	0.20m	0069
	Peat: dark brown black peaty deposit containing organic material (not bottomed)	n/a	0070

Table 17. Trench 16 deposits and details

6. Finds and environmental evidence

Richenda Goffin

6.1 Introduction

The only artefact collected from the evaluation is an iron horseshoe from an alluvial deposit which sealed the peats.

6.2 The horseshoe

An almost complete horseshoe was recovered. The surfaces are heavily concreted obscuring the nailholes and any other diagnostic features, so it can only be described in terms of its general shape and overall size. The shoe is 125mm in length (maximum), measures 118mm at its broadest point and weighs 422g. It is slightly assymetrical in shape, although whether this is because of an uneven build-up of corrosion products or the fact that one of the branches has broken off slightly is hard to know. There appears to be some indication of a calkin on the longest of these sides, but without an xray it is difficult to be certain. The shoe has a broad web size (between 40-50mm). Its overall shape and size suggests that it is late medieval to post-medieval in date.

7. Conclusions and recommendations for further work

Over much of the area examined by trial trenching, peat and waterlogged deposits were revealed. These deposits have been sampled by the Archaeo-Environmental team of Birmingham University for environmental and dating evidence and their conclusions are reported on in Appendix 3. They found that the peat and other waterlogged deposits were fairly dry and had probably become desiccated comparatively recently. Invertebrates and plant macrofossils were very poorly preserved and were of little interpretive value. Pollen was recovered from the samples and has been used to reconstruct past land use. Radiocarbon dates were taken from three locations through the sampled sequence.

To summarise the environmental report in Appendix 3:

- Peats started to grow within a blocked-off river channel from the Early Bronze Age (1930-1750 BC). Pollen evidence suggests that this was initially within an alder carr habitat but was later replaced by open sedge fen. The surrounding environment appeared to be open grassland, indicating probable managed pasture.
- A silty clay horizon is dated to the Roman period (AD 80-240). Pollen from this deposit suggested nearby arable land-use and the growing of barley. Agricultural intensification can lead to soil instability and might have led to the increased sediment observed in this horizon.
- The end of the organic sequence is dated to the medieval period (AD 1260 – 1290). The redeposited sands and gravels over these deposits are of probable modern origin.

Within the trenches a large drainage channel was encountered across the south of the site and this appears to correspond to a linear feature identified by the geophysical survey (Appendix 4). This appeared to be aligned with a culvert running under the railway embankment and is likely to be associated with land drainage in advance of the construction of the railway in the 1840s. It is probable that this feature was responsible for the drainage and drying out of the peat deposits witnessed during excavation and from the environmental samples.

An iron horseshoe of late medieval to post-medieval date was recovered as a metal-detector find from the silty-clay alluvial deposits that sealed the peat. This is likely to be intrusive as these deposits are probably of Roman date (Appendix 3). No other finds, deposits or features of archaeological interest were revealed.

Despite the widespread accumulation of peat and waterlogged deposits across the site, it is unlikely that organic remains of archaeological interest have survived the drainage and desiccation of the peats that took place in the 19th century. Further excavation is not recommended but some archaeological monitoring during any future development of the site might be advisable. It was not possible to investigate the north-west corner of the site where over 2m of modern deposits had accumulated. It is recommended that if any future development leads to the removal of this thick layer then further trenching should be conducted in this area.

8. Archive deposition

The archive is lodged with the SCCAS at its Ipswich office under the HER reference BRK 125. Digital photographs have been given the codes HLW 01 to 41. A summary of this project has also been entered onto OASIS, the online archaeological database, under the reference suffolkc1-122567.

Digital archive: R:\Environmental Protection\Conservation\Archaeology\Archive\Barking\ BRK Williamsport Way Lion Barn

Finds archive: SCCAS Bury St Edmunds, 8-10 The Churchyard, Shire Hall, Bury St Edmunds, Suffolk IP33 2AR.

9. Acknowledgements

Dr Jess Tipper produced the Brief and Specification. The project was managed by Dr Rhodri Gardner. The fieldwork was carried out by Jezz Meredith, Phil Camps and Preston Boyles with metal detecting by Roy Damant. Andy Beverton conducted the GPS survey and set out the trenches. The environmental sampling was conducted by Kristina Krawiec of the Archaeo-Environmental team of Birmingham University. Finds analysis and identification was by Richenda Goffin. The figures were prepared by Gemma Adams. Richenda Goffin commented on an earlier draft of this report.

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Suffolk County Council

The Archaeological Service

Economy, Skills and Environment
9–10 The Churchyard, Shire Hall
Bury St Edmunds
Suffolk
IP33 1RX

Appendix 1. Brief and Specification

Brief for a Geophysical Survey and a Trenched Archaeological Evaluation

AT

LAND SOUTH EAST OF WILLIAMSPORT WAY, LION BARN INDUSTRIAL ESTATE, NEEDHAM MARKET, SUFFOLK

PLANNING AUTHORITY:	Mid Suffolk District Council
PLANNING APPLICATION NUMBER:	Pre Application
HER NO. FOR THIS PROJECT:	To be arranged
GRID REFERENCE:	TM 099 539
DEVELOPMENT PROPOSAL:	Business park development
AREA:	2.4 ha.
CURRENT LAND USE:	Greenfield / Scrub
THIS BRIEF ISSUED BY:	Jess Tipper Archaeological Officer Conservation Team Tel. : 01284 741225 E-mail: jess.tipper@suffolk.gov.uk
Date:	1 November 2011

Summary

1.1 The applicant and Local Planning Authority (LPA) have been advised that the location of the proposed development could affect important archaeological deposits.

1.2 The applicant is required to undertake an archaeological field evaluation prior to consideration of the proposal, in accordance with a Written Scheme of Investigation. This information should be incorporated in the design and access statement, in accordance with policies HE6.1, HE6.2, HE6.3 and HE7.1 of PPS 5 *Planning for the Historic Environment*, in order for the LPA to be able to take into account the particular nature and the significance of any below-ground heritage assets at this location.

1.3 The archaeological contractor must submit a copy of their Written Scheme of Investigation (WSI) or Method Statement, based upon this brief of minimum

requirements (and in conjunction with our standard Requirements for a Trenched Evaluation, Geophysical Survey and Palaeoenvironmental Assessment 2011), to the Conservation Team of Suffolk County Council's Archaeological Service (SCCAS/CT) for scrutiny; SCCAS/CT is the advisory body to the LPA on archaeological issues.

1.4 The WSI should be approved before costs are agreed with the commissioning client, in line with Institute for Archaeologists' guidance. Failure to do so could result in additional and unanticipated costs.

1.5 Following acceptance, SCCAS/CT will advise the LPA that an appropriate scheme of work is in place.

1.6 The WSI will *provide the basis for measurable standards* and will be used to establish whether the requirements of the planning condition will be adequately met. If the approved WSI is not carried through in its entirety (particularly in the instance of trenching being incomplete) the evaluation report may be rejected.

Archaeological Background

2.1 The site lies in an area of high archaeological potential, immediately to the south of two ring ditches, which are probably the remains of Bronze Age burial mounds, recorded in the Suffolk Historic Environment Record. However, the location of the proposed development has not been subject to systematic archaeological survey. The location has good potential for the discovery of important hitherto unknown heritage assets of archaeological interest, in view of its proximity to known remains and given the landscape setting on the edge of the flood plain of the River Gipping. This location is topographically favourable for early occupation. There is also high potential for encountering palaeoenvironmental and geoarchaeological deposits, and the site has the potential for former land surfaces buried by later sedimentation.

Fieldwork Requirements for Archaeological Investigation

3.1 A geophysical survey and linear trenched evaluation, incorporating palaeo-environmental assessment, is required of the development area to enable the archaeological resource, both in quality and extent, to be accurately quantified.

3.2 Trial Trenching is required to:

- Identify the date, approximate form and purpose of any archaeological deposit, together with its likely extent, localised depth and quality of preservation.
- Evaluate the likely impact of past land uses, and the possible presence of masking colluvial/alluvial deposits.
- Establish the potential for the survival and significance of geoarchaeological and palaeoenvironmental evidence.
- Establish the suitability of the area for development.
- Provide sufficient information to construct an archaeological conservation strategy, dealing with preservation, the recording of archaeological deposits, working practices, timetables and orders of cost.

3.3 Further evaluation could be required if unusual deposits or other archaeological finds of significance are recovered; if so, this would be the subject of an additional brief.

3.4 Trial trenches are to be excavated to cover 5% by area, which is *c.*1,200.00m^2. These shall be positioned to sample all parts of the site, although the trench layout should be reviewed once the results of the geophysical survey are reported; the layout may need to be adjusted to test geophysical anomalies. Linear trenches are thought to be the most appropriate sampling method, in a systematic grid array. Trenches are to be a minimum of 1.80m wide unless special circumstances can be demonstrated; this will result in *c.*667.00m of trenching at 1.80m in width.

3.5 A scale plan showing the proposed location of the trial trenches should be included in the WSI and the detailed trench design must be approved by SCCAS/CT before fieldwork begins.

Arrangements for Archaeological Investigation

4.1 The composition of the archaeological contractor's staff must be detailed and agreed by SCCAS/CT, including any subcontractors/specialists. Ceramic specialists, in particular, must have relevant experience from this region, including knowledge of local ceramic sequences.

4.2 All arrangements for the evaluation of the site, the timing of the work and access to the site, are to be defined and negotiated by the archaeological contractor with the commissioning body.

4.3 The project manager must also carry out a risk assessment and ensure that all potential risks are minimised, before commencing the fieldwork. The responsibility for identifying any constraints on fieldwork (e.g. designated status, public utilities or other services, tree preservation orders, SSSIs, wildlife sites and other ecological considerations rests with the commissioning body and its archaeological contractor.

Reporting and Archival Requirements

5.1 The project manager must consult the Suffolk HER Officer to obtain an event number for the work. This number will be unique for each project or site and must be clearly marked on all documentation relating to the work.

5.2 An archive of all records and finds is to be prepared and must be adequate to perform the function of a final archive for deposition in the Archaeological Service's Store or in a suitable museum in Suffolk.

5.3 It is expected that the landowner will deposit the full site archive, and transfer title to, the Archaeological Service or the designated Suffolk museum, and this should be agreed before the fieldwork commences. The intended depository should be stated in the WSI, for approval.

5.4 The project manager should consult the intended archive depository before the archive is prepared regarding the specific requirements for the archive deposition and curation (including the digital archive), and regarding any specific cost implications of deposition.

5.5 A report on the fieldwork and archive must be provided. Its conclusions must include a clear statement of the archaeological value of the results, and their significance. The results should be related to the relevant known archaeological information held in the Suffolk HER.

5.6 An opinion as to the necessity for further evaluation and its scope may be given, although the final decision lies with SCCAS/CT. No further site work should be embarked upon until the evaluation results are assessed and the need for further work is established.

5.7 Following approval of the report by SCCAS/CT, a single copy of the report should be presented to the Suffolk HER as well as a digital copy of the approved report.

5.8 All parts of the OASIS online form http://ads.ahds.ac.uk/project/oasis/ must be completed and a copy must be included in the final report and also with the site archive. A digital copy of the report should be uploaded to the OASIS website.

5.9 Where positive results are drawn from a project, a summary report must be prepared for the *Proceedings of the Suffolk Institute of Archaeology and History*.

5.10 This brief remains valid for 12 months. If work is not carried out in full within that time this document will lapse; the brief may need to be revised and re-issued to take account of new discoveries, changes in policy and techniques.

Standards and Guidance

Further detailed requirements are to be found in our Requirements for a Trenched Archaeological Evaluation 2011 v1.1, Requirements for a Geophysical Survey 2011 v1.1, and Requirements for a Palaeoenvironmental Assessment 2011 v1.1.

Standards, information and advice to supplement this brief are to be found in *Standards for Field Archaeology in the East of England*, East Anglian Archaeology Occasional Papers 14, 2003.

The Institute for Archaeologists' *Standard and Guidance for archaeological field evaluation* (revised 2001) should be used for additional guidance in the execution of the project and in drawing up the report.

The geophysical survey must be undertaken in accordance with *The Use of Geophysical Techniques in Archaeological Evaluation* (Gaffney, Gater and Ovenden 2002) *and Geophysical survey in Archaeological Field Evaluation* (David 1995) and *also Geophysical Data in Archaeology: A Guide to Good Practice* (Schmidt 2001) for best practice in the creation and use of digital geophysical data.

Notes

The Institute for Archaeologists maintains a list of registered archaeological contractors (www.archaeologists.net or 0118 378 6446). There are a number of archaeological contractors that regularly undertake work in the County and SCCAS will provide advice on request. SCCAS/CT does not give advice on the costs of archaeological projects.

Appendix 2. Context list

Context No	Feature	Feature	Description/Interpretation	Finds	Overall	Env. Sample	Trench
0001		Other	Unstratified finds - whole site	No		No	
0002		Layer	Topsoil, general number for whole area. Mainly stripped off from most of the site, probably quite recently, and bunded to site edge	No		No	
0003			Natural - general number for whole site - where seen away from peat (eg Trs 1, 2, part 3 & 10) mainly mottled pale yellow brown sand & gravel with occasional mid & darker grey brown patches. Use 0071 where seen under peat - here pale grey sand & gravel	No		No	
0004			Number cancelled	No		No	
0005			Number cancelled	No		No	
0006			Number cancelled	No		No	
0007		Layer	Firm mid reddish brown silty clay containing very occasional small & medium sized sub-angular stones. Depth 0.12m	No		No	1
0008		Layer	Firm dark blue-grey silty clay, no inclusions. Depth 0.14m	No		No	1
0009		Layer	Dark blue-grey, loose, silty sand containing moderate small & medium sub-angular to sub-rounded stones. Depth 0.23m	No		No	1
0010		Layer	Firm, dark brownish grey, silty clay containing moderate small to medium sub-angular & sub-rounded stones. Depth 0.14m	No		No	2
0011		Layer	Loose, dark grey-brown silty sand with occasional medium sized sub-angular & moderate small stones	No		No	2
0012		Layer	Same as 0010. Depth 0.08m	No		No	3

Context No	Feature	Feature	Description/Interpretation	Finds	Overall	Env. Sample	Trench
0013		Layer	Same as 0008. Depth 0.16m	No		No	3
0014		Layer	Dark grey black, loose, silty sand with occasional small sub-angular stones. Depth 0.32m	No		No	3
0015		Layer	Very black silty sand, loose, with frequent small & medium sub-angular to sub-rounded stones. Depth 0.17m	No		No	3
0016		Layer	Firm dark brown silty clay with occasional pieces of chalk; root disturbance. Depth 0.22m	No		No	4
0017		Layer	Firm mid grey-brown silty clay. Depth 0.24m	No		No	4
0018		Layer	Similar to 0008, merging into 0017	No		No	4
0019		Layer	Dark brown black peaty deposit containing organic material. Not bottomed. In machine test hole adj this deposit c.0.65m depth	No		No	4
0020		Layer	Mid reddish brownsilty sand, loose compaction, occasional small stones. Depth 0.35m	No		No	5
0021		Layer	Loose, light yellow sand, very occasional small stones. Depth 0.25m	No		No	5
0022		Layer	Light, creamy grey brown firm silty clay; depth 0.12m	No		No	6
0023		Layer	Similar to 0017; depth 0.25m	No		No	6
0024		Layer	Similar to 0018; depth 0.16m	No		No	6
0025		Layer	Same as 0019; not bottomed.	No		No	6

Context No	Feature	Feature	Description/Interpretation	Finds	Overall	Env. Sample	Trench
0026		Layer	Firm, mid brown - streaked grey silty clay; depth 0.38m	No		No	7
0027		Layer	Dark grey-black, loose silty sand with occasional small & medium sized sub-angular stones; depth 0.25m	No		No	7
0028		Layer	Black, loose silty sand with occasional small & medium sixed rounded stones, merges with 0027 above; depth 0.2m	No		No	7
0029		Layer	Soft / loose dark reddish brown sandy silt with occasional small sub-angular stones; 0.36m	No		No	8
0030		Layer	Light yellow grey, loose sand; depth 0.12m	No		No	8
0031		Layer	Sama as 0017; depth 0.4m	No		No	8
0032		Layer	Sama as 0018; depth 0.2m	No		No	8
0033		Layer	Same as 0019, not bottomed. Machine test hole at NW end of trench indicated depth of peat to be c.0.7m	No		No	8
0034		Layer	Dark grey brown, soft / loose sandy silt with moderate small stones; depth 0.4m	No		No	9
0035		Layer	Dark red brown sandy silt (colluvium layer) containing moderate small & medium sub-angular stones, occ larger stones; depth at NE end of trench - 0.4m, at SW end - 0.1m	No		No	9
0036		Layer	Same as 0017; depth 0.36m	No		No	9
0037		Layer	Same as 0018; depth 0.25m	No		No	9
0038		Layer	Same as 0019; depth 0.18m	No		No	9

Context No	Feature	Feature	Description/Interpretation	Finds	Overall	Env. Sample	Trench
0039		Layer	Similar to 0038 but darker & less organic remains; depth 0.5m	No		No	9
0040		Layer	Mid to dark grey sandy silt (colluvium) with occasional small stones, loose; depth 0.3m	No		No	9
0041		Layer	Light yellow sand, loose; depth 0.2m	No		No	9
0042		Layer	Dark grey silty clay, firm; depth 0.08m	No		No	9
0043		Layer	Dark grey silty clay, firm; depth 0.08m	No		No	9
0044		Layer	Same as 0034; depth 0.3m	No		No	10
0045		Layer	Mid reddish brown, loose, sandy silt with occasional small sub-angular stones & rounded medium stones; depth 0.7m	No		No	10
0046		Layer	Similar to 0040 - stops 0.52m SW of section 11, all along NE edge of trench, with gradual concave slope; depth 0.32m	No		No	10
0047		Layer	Western limit of water laid, peat & associated deposits Same as 0034; depth 0.4m	No		No	11
0048		Layer	Light yellow loose sand; depth 0.15m	No		No	11
0049		Layer	Mid brown, firm silty clay with moderate small & medium stones, occasional larger nodules; depth 0.4m	No		No	11
0050		Layer	Sama as 0008; depth 0.15m	No		No	11
0051		Layer	Light grey silty clay mixed with gravel of medium sub-angular stones; depth 0.08m	No		No	11

Context No	Feature	Feature	Description/Interpretation	Finds	Overall	Env. Sample	Trench
0052		Layer	Same as 0019; depth 1m	No		No	11
0053		Layer	Similar to 0049; depth 0.42m	No		No	12
0054		Layer	Same as 0017; depth 0.35m	No		No	12
0055		Layer	Same as 0018; depth 0.08m	No		No	12
0056		Layer	Same as 0019; depth 0.32m	No		No	12
0057		Layer	Firm, blue grey silty clay; depth 0.4m	No		No	13
0058		Layer	Similar peat to 0019 but with gravel seams throughout; depth 0.4m	No		No	13
0059		Layer	Same as 0057; depth 0.58m	No		No	14
0060		Layer	Same as 0058; depth 0.48m	No		No	14
0061		Layer	Same as 0049; depth 0.52m	No		No	15
0062		Layer	Same as 0017; depth 0.32m	No		No	15
0063		Layer	Same as 0018; depth 0.2m	No		No	15
0064		Layer	Same as 0019, not bottomed.	No		No	15

Context No	Feature	Feature	Description/Interpretation	Finds	Overall	Env. Sample	Trench
0065		Layer	Briefly described from machine test pit: clay similar to 0017; depth c.0.5m	No		No	5
0066		Layer	Briefly described from machine test pit: peaty and dark silty deposits; depth c.0.65m	No		No	5
0067		Layer	Firm/crumbly dark greyish brown silty clay with moderate small chalk particles & occasional small stones; depth 0.35m	No		No	16
0068		Layer	Same as 0017; depth 0.3m	No		No	16
0069		Layer	Same as 0018; depth 0.15m	No		No	16
0070		Layer	Same as 0019, not bottomed	No		No	16
0071		Layer	Natural - under peat: pale grey sand & gravel, waterwashed (eg all Trs except 1, 2, part 3 & 10 - here use 0003)	No		No	
0072	0072	Ditch Cut	Large post-medieval drainage channel across S of site, encountered in Trs 8, 11, 12, 15 & 16 after which lines up with calvert under railway line so probably contemporary with this. Up to c.15m in width (Tr 12) and at least 1.6m deep where bottomed (Tr 16)	No		No	
0073	0072	Ditch Fill	General fill number for this post-med feature. Mainly alternating bands of peat and yellow / mixed sand	No		No	

Appendix 3. Palaeo-environmental Survey

BIRMINGHAM ARCHAEO-ENVIRONMENTAL BAE

A palaeoenvironmental assessment of sediments recovered from Needham Market, Suffolk.

K. Krawiec, E. Hopla, B. Gearey and J. Carrott

August 2012

SCCAS- BAE-BA2170

A palaeoenvironmental assessment of sediments recovered from Needham Market, Suffolk.

By

K. Krawiec, E. Hopla, B. Gearey and J. Carrott

August 2012

Summary

In March 2012 BAE were commissioned to undertake environmental sampling at Needham Market, Suffolk in advance of development. The site lies on the former floodplain of the River Gipping. BAE have previously undertaken investigations of the River Gipping to the north at Stowmarket (in advance of the relief road) which recovered sediments infilling a former channel dating from the Mesolithic to the Medieval period (Hopla et al., 2008). Samples for multi-proxy analysis were recovered at Needham from a trial trench located in the centre of the site. Three radiocarbon dates from the sequence indicate that organic sediment accumulation began during the Bronze Age and ended during the Medieval period when inorganic alluvial deposits were deposited across the site by fluvial processes. The assessments demonstrate variable preservation of palaeoenvironmental proxies, with plant macrofossils and insect remains poorly preserved. Pollen preservation varies somewhat, but counts were sufficient to enable limited interpretation, which suggests the landscape at Needham Market was open grassland from the Bronze Age onwards, with evidence for possible arable agriculture during the Romano-British period. No further analytical work is recommended on these samples.

KEYWORDS: Peat, River Gipping, Pollen, Plant macrofossils, Beetles,

Contact address for authors:

Birmingham Archaeo-Environmental
Institute of Archaeology and Antiquity
University of Birmingham
Edgbaston
Birmingham
B15 2TT

1. INTRODUCTION

In March 2012 BAE were commissioned by Suffolk County Council Archaeology Service to recover environmental samples from a peat deposit recorded during trial trenching at Needham Market, Suffolk. The samples were recovered from a test pit in the centre of the site using monolith tins and bulk sample bags. The site is in close proximity to Anglo-Saxon activity to the south. In light of other sites investigated in the Gipping valley (e. g. Hopla *et al.,* 2010) the site has considerable potential to yield valuable palaeoenvironmental remains which might assist in understanding the archaeological record within its landscape context.

2. METHODS

2.1 Fieldwork

The location of the test pit was surveyed by staff at SCCAS and was located where the watertable was at its lowest in order to facilitate sample recovery. The samples were recovered using 25cm monolith tins and bulk sample bags. The section was hand drawn and photographed (Plates 1 and 2) and the stratigraphy of the deposits was logged in the field using the Troels Smith (1955) method (Table 1).

2.2 Pollen

A total of 8 sub-samples were taken at 8cm intervals for pollen assessment. Pollen preparation followed standard techniques including potassium hydroxide (KOH) digestion, hydrofluoric acid (HF) treatment and acetylation (Moore *et al.,* 1991). A count of at least 125 total land pollen grains (TLP) excluding aquatics and spores were attempted for each sample.

2.3 Insect Remains and Plant Macrofossils

Two bulk (8L) samples were processed using the standard methods of paraffin flotation for insect remains and washover technique for extraction of plant

macrofossils (Kenward *et al.,* 1980: 11). The washovers exhibited waterlogged preservation of organic remains and were kept wet and examined for plant and invertebrate remains (see Kenward *et al*., 1986). Low-power microscopy (x7 to x45) was employed and the washovers were separated into two fractions (0.3 to 4 mm and greater than 4 mm) to facilitate recording. One of the sample residues was primarily organic and was examined wet, whilst the other was inorganic and this was dried prior to recording.

All of the components of the processed sample fractions were recorded using a five-point semi-quantitative scale; fractions were generally scanned until no new remains were observed and a sense of the abundance of each taxon or component (relative to the processed fraction as a whole) was achieved. The abundance scale employed was: 1 – few/rare, up to 3 individuals/items or a trace level component of the whole; 2 – some/present, 4 to 20 items or a minor component; 3 – many/common, 21 to 50 or a significant component; 4 – very many/numerous, 51 to 200 or a major component; and 5 – abundant/super-abundant, over 200 items/individuals or a dominant component of the whole.

Plant macrofossil remains were identified as closely as possible by comparison with reference material (where available) and the use of published works (e.g. Cappers *et al*., 2006). Nomenclature for plant taxa follows Stace (1997). Non-molluscan invertebrate macrofossils were identified with reference to published works and within the constraints of the assessment (utilising Harde, 1984 and Lindroth, 1974, for example, to identify beetles to a basic level).

2.4 Radiocarbon dating

Three bulk (top, middle and base of the organic deposits) sediment samples were submitted to Beta Analytic Inc., Florida, for AMS dating. The samples underwent acid/alkali/acid pre-treatment prior, during which process it was determined that the sample from the top of the sequence was contaminated by petrochemicals and was therefore unsuitable for radiocarbon dating.

3. RESULTS

3.1 Stratigraphy

The trial trench was located in the centre of the site (Fig 1). The basal sands and gravels were reached at 14.66m AOD. These were overlain by a very dry well humified peat (Unit 6) 0.34m thick which then transitioned sharply into a 0.16m thick deposit of blue grey silt clay (Unit 5) which contained *Phragmites* (reed) remains throughout. This transitioned sharply into another dry well humified silty peat (Unit 4), which was overlain by a 0.10m thick layer of grey, fluvial clay (alluvium; Unit 3). This alluvium was some 0.40m thick and became more oxidised towards the top of the profile (Unit 2). This was finally sealed by a thick (0.80m) layer of re-deposited orange yellow sand (Unit 1).

Monolith tins were taken from the lower peat and grey silt units along with bulk samples in 0.10m spits. Bulk AMS dating samples were also recovered from the top and bottom of the peat sequence (Table 2).

3.2. Radiocarbon dating

The results of the radiocarbon dating are summarised in Table 3 with all calibrations calculated using Intcal04 (Reimer *et al*., 2004). The basal sample (wood; 1.98-1.99m) was dated to 3520+/-30BP (Cal BC 1930 to 1750, Cal BP 3880 to 3700, Beta 321009). The sample (peat) from 1.66m produced a date of 1860+/-30 BP (Cal AD 80 to 240, Cal BP 1870 to 1720, Beta-321008). The top sample from 1.30-1.32m was dated to 730+/-30 BP (Cal AD 1260 to 1290, Cal BP 690 to 660, Beta-321007). This indicates that peat accumulation began during the early Bronze Age and continued up into the middle of the Medieval period. The generally slow sediment accumulation rates (see below) probably demonstrate marginal conditions for peat formation at the sampling site, which is probably also indicated by the results of the plant macrofossil assessments.

3.3 Pollen

Concentration and preservation was excellent in the upper three samples (1.34m, 1.46m and 1.54m). Lower concentrations were apparent in sample 1.62m as well as a decrease in the preservation to medium. Corrosion was particularly evident on some of the grains as well as crumpling. The sample from 1.70m yielded extremely low concentrations and an assessment count was not possible and this sample has therefore been omitted from the pollen diagram. Concentrations increased again in the lower three samples (1.78m, 1.86m and 1.98m) however, preservation remained medium-low with high levels of corrosion, degradation and splitting evident on many of the grains. All percentage figures are of Total Land Pollen (TLP) unless otherwise specified.

The base of the sequence is dated to 3520+/-30BP (Cal BC 1930 to 1750, Cal BP 3880 to 3700, Beta 321009) demonstrating that organic accumulation began during the early Bronze Age. The basal sample of the diagram is dominated by trees and shrubs up to 60%. This largely consists of *Alnus glutinosa* (alder) with *Corylus avellana*-type (most probably hazel) present up to 10% along with *Pinus sylvestris* (Scots pine), *Quercus* (oak) and single grains of *Betula* (birch), *Ulmus* (elm), *Tilia* (lime) and *Hedera helix* (Ivy). Herbaceous pollen is dominated by Poaceae (wild grasses) and Cyperaceae (sedges) up to 35% along with occasional grains of Caryophyllaceae (pink family), Chenopodiaceae (goosefoot family), Lactuceae (dandelions), *Plantago lanceolata* (ribwort plantain) and *Rumex* (docks).

The pollen record reflects a floodplain environment, which would have initially at least, been dominated by alder fen carr with sedges and small areas of grasses, most likely *Phragmites* (reed) also on the floodplain. The dryland vegetation appears to have been more open, but there is some evidence for woodland including at best limited areas of *Corylus* and *Quercus*. The record of *P. lanceolata* and Lactuceae indicates some open, grassy areas in the wider landscape, which might have been created and/or maintained by human activity. It is also likely that the Poaceae curve includes pollen from dryland grasses reflecting a largely open environment.

Herbaceous pollen (c. 80%) dominates the rest of the sequence from 1.87m to the top of the diagram. Cyperaceae increases to values between 40-60% throughout with a rise in Pocaeae (30-40%) also recorded. Other herbs include Lactuceae and *Plantgao lanceolata* <10%, Rubiaceae (bedstraw family), *Rumex* (docks and Rosaceae (rose family) <5%, with occasional grains of *Artemesia* (mugwort), Caryopyllaceae (pink family), Chenopodiaceae (goosefoot family), *Cirsuim* (thistles) and *Filipendula* (meadowsweet). *Alnus glutinosa* declines rapidly in association with the increase in Cyperaceae and is recorded at values less than 10% by 1.87m, which continue to fall throughout the diagram. Traces of other trees/shrubs *Betula, Ulmus* and *Tilia* have also disappeared by the middle of the sequence, for which a date of 1860+/-30 BP (Cal AD 80 to 240, Cal BP 1870 to 1720, Beta-321008) is available at 1.66m. Increases in *Plantago lanceolata*, Lactuceae and *Pteridium* (bracken) are also recorded around this point, with the beginning of a *Hordeum*-type (barley, but can include wild grasses) curve.

The pollen diagram thus reflects a largely open local floodplain dominated by *Phragmites* (reeds) and other wetland grasses. The low values of trees and percentages of Poaceae and suite of other herbs implies that the drier soils around the sampling site remained largely open throughout the Bronze Age into the Romano-British period, with indications of pastoral and perhaps also arable farming. A slight increase in arboreal pollen is apparent towards the top of the sequence with *Quercus* reaching values up to 10% and *Ulmus* and *Salix* re-appear at trace values, suggesting some recovery in woodland. The record terminates before 730+/-30 BP (Cal AD 1260 to 1290, Cal BP 690 to 660, Beta-321007).

3.3 Plant macrofossils and beetles

The results of the assessments of the bulk samples are presented below in stratigraphic sequence uppermost first. A brief summary of the processing method and an estimate of the remaining volume of unprocessed sediment follow after the sample numbers in round brackets.

Context 1.30-1.40 metres depth

Sample 1/T (1 kg/~1 litre sieved to 300 microns with washover; ~1.5 litres of unprocessed sediment remains)

Moist, dark brown to dark grey-brown (with a slight purplish cast), somewhat indurated and slightly brittle to crumbly, slightly sandy amorphous organic sediment, with occasional rounded quartz pebbles (to 22 mm).

The small washover (100 ml) was mostly small (1 to 2 mm) lumps of undisaggregated organic sediment 'crumb', with some indeterminate fine plant detritus. Some 'seeds' were present including sedge (*Carex*) nutlets and possible nightshade family (cf. Solanaceae) seeds and there were occasional fragments of insect cuticle. The insect remains were largely indeterminate, with a few non-diagnostic beetle body parts, such as abdominal sclerites, represented.

The modest residue (200 ml) was almost entirely composed of further undisaggregated (somewhat indurated) organic sediment 'crumb', with a little fine sand and a single rounded quartz pebble (to 22 mm).

Context 1.89-1.99 metres depth

Sample 2/T (1 kg/~1 litre sieved to 300 microns with washover; ~2.5 litres of unprocessed sediment remains)

Wet to waterlogged, dark brown to dark grey-brown, brittle to crumbly (working somewhat soft), slightly humic, slightly sandy silt, with stones (2 to 20 mm) present (mostly angular flint). The sample gave a slight sulphide smell when lumps of sediment were broken.

The very small washover (20 ml) was mostly small (1 to 2 mm) lumps of undisaggregated sediment 'crumb' and indeterminate plant detritus, with a little sand and a few decayed 'woody' fragment (to 20 mm; wood or woody root). Occasional 'seeds' were present including sedge (*Carex*) nutlets and common nettle (*Urtica dioica* L.) achenes. There were also occasional fragments of insect cuticle but most of these could not be identified further; there were a few non-diagnostic beetle body parts, including leg sclerites, and a single head fragment of a rove beetle (Staphylinidae).

The small residue (dry weight 116.6 g) was mostly fine sand, with small angular flints (to 10 mm) and a few larger angular flints (to 34 mm) present. None of the flint appeared to have been worked.

4. DISCUSSION

The basal deposits at Needham Market are coarse sands and gravels, which were probably deposited by fluvio-glacial processes during the Late Glacial period (c. 13, 000 years before present or earlier). These are overlain by a dry well humified peat which indicates paludification of these gravels and the subsequent growth of peat, probably associated with rises in the local watertable during the Bronze Age. The sequence might alternatively reflect the infilling of a palaeochannel which was previously taking flow but became cut off from the river system through channel avulsion. There is palaeoenvironmental evidence from elsewhere in Suffolk for increasingly wet conditions in river valleys during the earlier Bronze Age (e.g. Stowmarket also on the River Gipping; Gearey *et al*. 2010). This may well be related to similar evidence from other areas of England for a rise in sea level and possible climatic deterioration during the earlier Bronze Age (e.g. Macklin *et al*. 2009).

The pollen data indicates that peat formation was initially within an alder carr environment, but this did not persist and the subsequent floodplain environment was apparently dominated by open sedge fen, with macrofossil remains of this plant apparent in the bulk samples. Whilst the palynological record is thus probably dominated by this local wetland vegetation, there is also an indication of the vegetation growing on the drier soils beyond the wetland edge. Some patchy deciduous woodland seems to have been present, but the environment otherwise appears to have been largely open grassland, with a range of herbacaeous taxa typical of meadow, pastoral habitats. This implies the presence of human communities in the area, who had presumably cleared the woodland for farming and settlement during the earlier Bronze Age. Palynological data from other sites in Suffolk also hint at the presence of open, meadow like environments in river valleys during the Bronze Age (e. g. Krawiec *et al*. 2009).

The pollen record demonstrates little detectable change in the vegetation present on both the wetland and dryland areas throughout the lower part of the record. The sharp stratigraphic transition to a minerogenic deposit (Unit 5 silt clay) indicates a change in the depositional regime, perhaps a period of flooding which deposited silty-clay over

the floodplain, or alternatively reactivation of the abandoned channel. The presence of sub-fossil remains of *Phragmites* (reeds) throughout Unit 5 suggests a relatively sluggish flow of water. Evidence for standing water on the sampling site is also apparent in the increase in *Sparganium* (pond weeds) in the pollen record.

The change from organic to inorganic deposition is dated to Cal AD 80 to 240, Cal BP 1870 to 1720 (Beta-321008) implying this event occurred during the Romano-British period. There is palynological evidence for increased human activity at this point in the form of rises in *P. lanceolata* and Lactuceae and the beginning of a *Hordeum*-type curve. The latter pollen type includes wild grasses *Glyceria* sp. (sweet vernal grass) as well as *Hordeum vulgare* (barley) but might reflect arable cultivation close to the sampling site. It is unclear whether this evidence for possible intensification in local farming activity can be associated with the stratigraphic evidence (Unit 5) for possible raised water tables/flooding at the sampling site: agricultural intensification may lead to soil instability and increased sediment input into watercourses.

Sediment accumulation also appears to have been relatively slow up until this point, with the radiocarbon dates from the base and middle of the sequence equating to an accumulation rate of c. 62 years cm^{-1} between 1.98 to 1.66m. Accumulation rates for the upper part of the sequence (1.66 to 1.30m) increase to c. 30 years cm^{-1}, perhaps as a result of slightly wetter conditions on the floodplain more suitable for peat accumulation. This may also be evidenced by the improved pollen preservation towards the top of the sequence.

The silty peat (Unit 4) overlying Unit 3 suggests a reversion to sediment accumulation in a semi-terrestrial environment, again apparently dominated by sedge fen. The pollen record seems to indicate some recovery in oak woodland on the drier soils beyond the floodplain towards the top of the sequence, but the sampling intervals are too broad to permit detailed interpretation. The pollen record terminates prior to Cal AD 1260 to 1290, Cal BP 690 to 660 (Beta-321007) with a final transition from organic to minerogenic alluvial units (Units 2 and 3). These deposits suggest a final phase of overbank sedimentation during the Medieval period. The overlying re-deposited sands and gravels have clearly been imported from elsewhere, possibly the recent development of the business park adjacent to the site.

5. CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER ANALYSIS

The assessments have shown variable preservation of palaeoenvironmental material in the deposits at Needham Market. Sufficient pollen was present to permit some tentative interpretation and radiocarbon dating has demonstrated that the deposits began to accumulate during the Bronze Age within a floodplain environment, with organic sedimentation ending during the Medieval period when inorganic, alluvial clays and silts were deposited across the site.

The bulk samples produced little interpretable data. Although the upper of the two submitted sediment samples was clearly primarily composed of organic material and some organic content was also present in the lower sample, identifiable plant and invertebrate remains were very few. Both deposits contained remains of sedges most species of which grow in wet/waterlogged ground typical of floodplains and confirmed by the pollen record. Beyond this the macrofossil remains were of no interpretative value.

The palynological data is of some note as it indicates that the landscape around the site may already have been relatively open and cleared of its woodland cover by the Bronze Age. The presence of 'anthropogenic indicator' such as ribwort plantain and dandelions suggest open, meadow like habitats created and maintained by human activity. The environment appears to have remained relatively open and probably farmed/settled for much of the time through later prehistory into the Romano-British period, when there is some indication for a possible intensification in agriculture and perhaps the local cultivation of barley. This is closely associated with evidence for increasing wetness/flooding on the sampling site, which resulted in the deposition of a layer of silty clay.

There is some evidence that the generally poor preservation of the palaeoenvironmental record might be attributed to recent processes rather than conditions during sediment accumulation in the past. Observations made in the field

noted that the sampled deposits were dry (the present day water table being perched above them by an alluvial clay – the moist to wet/waterlogged condition of the samples as presumably occurring during sampling) which would account for the highly humified condition of their organic content; i.e. the permanently waterlogged anoxic conditions which can result in good preservation of uncharred organic remains have not prevailed, with drainage and subsequent desiccation affecting the micro and macrofossil content of the sediments. To this end, not further palaeoenvironmental analyses are recommended at this time.

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Figure.1. Trench Locations

Plate 1: Section before sampling

Plate 2: Tins in situ

Table 1.Stratigraphic sequence

0-0.80m		**Da**	**St**	**El**	**Dr**	**UB**
	1	0	0	1	0	
	Gmaj 2 gmin2					
	Redeposited yellow orange sand (Unit 1)					
0.80-1.20m	**Da**	**St**	**El**	**Dr**	**UB**	
	2	0	0	1	3	
	As3 Ag1					
	Oxidised orange alluvial clay (Unit 2)					
1.20-1.30m	**Da**	**St**	**El**	**Dr**	**UB**	
	2	0	0	1	2	
	As3 Ag1					
	Grey unoxidised alluvial clay (Unit 3)					
1.30-1.50m	**Da**	**St**	**El**	**Dr**	**UB**	
	3	0	0	1	4	
	Dh3 Ag1					
	Dry well humified peat (Unit 4)					
1.50-1.66m	**Da**	**St**	**El**	**Dr**	**UB**	
	2	0	0	1	4	
	As1 Ag3					
	Grey silt with occasional reed remains (Unit 5)					
1.66-1.99m	**Da**	**St**	**El**	**Dr**	**UB**	
	3	0	0	1	4	
	Dh3 Ag1					
	Dry well humified peat (Unit 6)					
1.99m	Grey flinty sands and gravels					

Table 2. Samples register from Needham Market

Sample number	Type	Sample depth (not od)
1	Monolith tin 25cm	1.50m-1.75m
2	Monolith tin 25cm	1.74-1.99m
3	Bulk	1.30-1.40m
4	Bulk	1.40m-1.50m
5	Bulk	1.50-1.66m
6	Bulk	1.66-.176m
7	Bulk	1.89-1.99m
	AMS	1.30-1.34m
	AMS	1.66m
	AMS	1.98-1.99m

Table 3. Radiocarbon Dating from Needham Market (Beta Analytic Ltd)

Lab no	Material	13C/12C	Radiocarbon Age	Calibrated Age
321007 1.30-1.32m	Peat: Acid/alkali/acid	-28.5 o/oo	730+/-30 BP	Cal AD 1260 to 1290 (Cal BP 690 to 660)
321008 1.66m	Peat: Acid/alkali/acid	-28.8 o/oo	1860+/-30 BP	Cal AD 80 to 240 (Cal BP 1870 to 1720)
321009 1.98-1.99m	Wood: acid/alkali/acid	-29.2 o/oo	3520+/-30BP	Cal BC 1930 to 1750 (Cal BP 3880 to 3700)

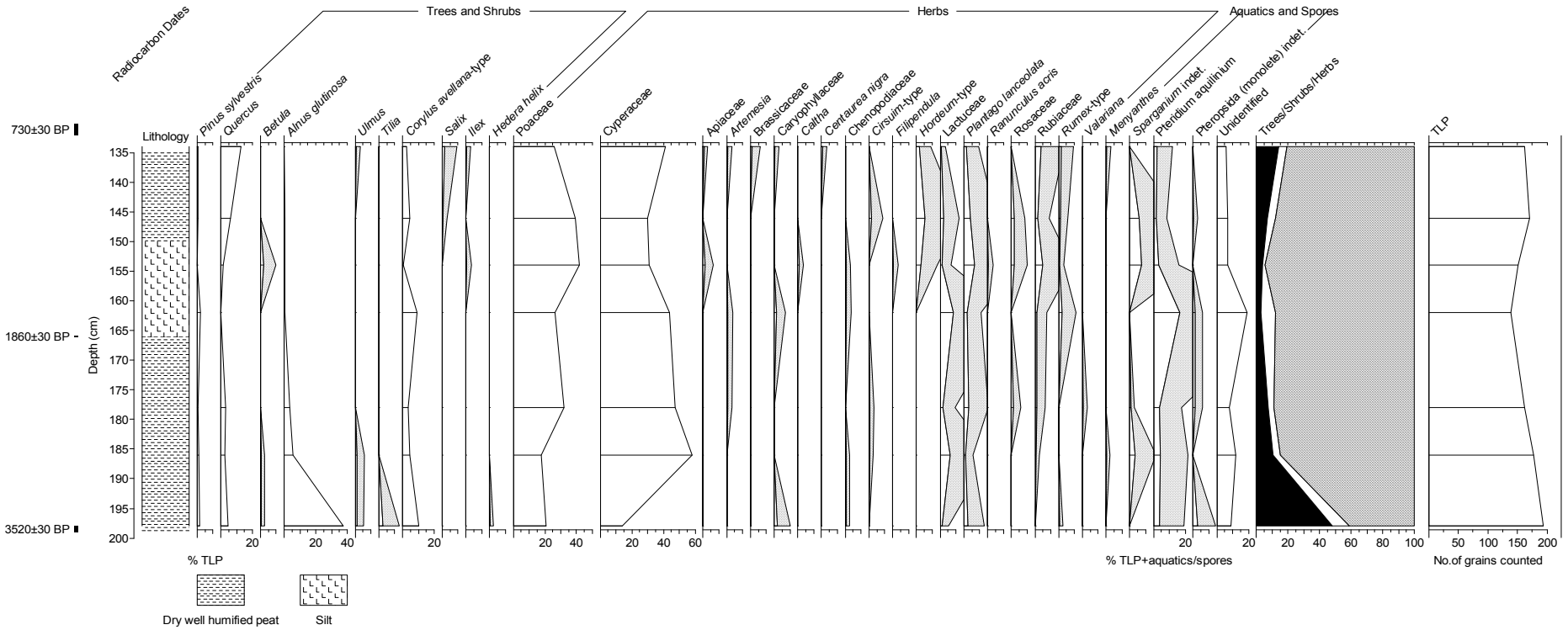

Figure 2: Needham Market Percentage Pollen diagram (shading = exaggeration x 5)

Appendix 4. Geophysical Survey

STRATASCAN

Geophysical Survey Report

Needham Market, Suffolk

for

Suffolk County Council

January 2012

Job ref. J3019

Melanie Biggs BSc (Hons)

Document Title:	**Geophysical Survey Report Needham Market, Suffolk**
Client:	**Suffolk County Council**
Stratascan Job No:	**J3019**
Survey Date:	**December 2012**
Techniques:	**Detailed magnetic survey (gradiometry)**
National Grid Ref:	**TM 100 540**

Plate 1: View north west across the survey area

Field Team:	**Sean Parker BSc (Hons), Tim Lewis BA (Hons) and Steve Hamfleet MSc**
Project Manager:	**Simon Haddrell B.Eng (Hons) AMBCS PIFA**
Report written by:	**Melanie Biggs BSc (Hons)**
CAD illustration by:	**Melanie Biggs BSc (Hons)**
Checked by:	**Peter Barker C.Eng MICE MCIWEM MIFA FCInstCES**

Stratascan Ltd.
Vineyard House
Upper Hook Road
Upton upon Severn
WR8 0SA

Tel: 01684 592266
Fax: 01684 594142
Email: ppb@stratascan.co.uk
www.stratascan.co.uk

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1 SUMMARY OF RESULTS

A detailed gradiometry survey was conducted over approximately 2.4 hectares of an area which had been cleared down to bare soil. The survey has identified very little in the way of possible archaeological features. A weak positive linear feature appears towards the south of the survey area and has tentatively been marked up as possible archaeology. Due to the disturbed nature of the site, this feature could be related to the site clearance process. Other features found include probable geological or pedological responses, magnetic disturbance due to nearby ferrous objects and areas of probable made or heavily disturbed ground.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned to undertake a geophysical survey of an area outlined for development. This survey forms part of an archaeological investigation being undertaken by Suffolk County Council.

2.2 Site location

The site is located on the south eastern outskirts of Needham Market, Suffolk at OS ref. TM 100 540.

2.3 Description of site

The survey area is approximately 2.4 hectares of cleared ground down. The site surface is mainly bare soil with some areas of overgrowth, log piles, machinery stores (see ***Plate 3***) and built up gravelled areas (see ***Plate 3***). Some areas are covered by large puddles (see ***Plate 1***). A train line runs along the western boundary of site behind a tall metal fence from the north west to the south east. Buildings and built up land lie to the north of the survey area (see ***Plate 1***).

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Plate 2: Rough terrain and built up gravelled areas. Looking north east.

Plate 3: Machinery stores in the south of the survey area.

2.4 Geology and soils

The underlying geology is chalk of the Newhaven formation (British Geological Survey website). The drift geology is Alluvium clay and silt (British Geological Survey website).

The overlying soils are known as Ludford which are typical argillic brown earths soils. These consist of deep well drained fine loamy, coarse loamy and sandy soils which can be flinty and in places and over gravel. (Soil Survey of England and Wales, Sheet 6 South East England).

2.5 Site history and archaeological potential

The following information was provided via correspondence with the client:

There is a significant multi-period site (Anglo Saxon and some prehistoric) at Gallows Hill Quarry *c*. 900m to the SE. Part of it includes a Roman Road which would pass approx 150m to the south of the survey area. This is most likely to be associated with the Roman occupation of the area rather than the Saxon, which so far takes the form of dispersed sunken-floored buildings with few boundaries.

2.6 Survey objectives

The objective of the survey was to locate any features of possible archaeological significance in order that they may be assessed prior to development.

2.7 Survey methods

Detailed magnetic survey (gradiometry) was used as an efficient and effective method of locating archaeological anomalies. More information regarding this technique is included in the Methodology section below.

3 METHODOLOGY

3.1 Date of fieldwork

The fieldwork was carried out on Saturday 17th December 2011. Weather conditions during the survey were dry and frosty.

3.2 Grid locations

The location of the survey grids has been plotted in Figure 2 together with the referencing information. Grids were set out using a Leica Smart Rover RTK GPS.

An RTK GPS (Real-time Kinematic Global Positioning System) can locate a point on the ground to a far greater accuracy than a standard GPS unit. A standard GPS suffers from errors created by satellite orbit errors, clock errors and atmospheric interference, resulting in an accuracy of 5m-10m. An RTK system uses a single base station receiver and a number of mobile units. The base station re-broadcasts the phase of the carrier it measured, and the mobile units compare their own phase measurements with those they received from the base station. A SmartNet RTK GPS uses Ordnance Survey's network of over 100 fixed base stations to give an accuracy of around 0.01m.

3.3 Survey equipment and gradiometer configuration

Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.2 nanoTeslas (nT) in an overall field strength of 48,000nT, can be accurately detected using an appropriate instrument.

The mapping of the anomaly in a systematic manner will allow an estimate of the type of material present beneath the surface. Strong magnetic anomalies will be generated by buried iron-based objects or by kilns or hearths. More subtle anomalies such as pits and ditches can be seen if they contain more humic material which is normally rich in magnetic iron oxides when compared with the subsoil.

To illustrate this point, the cutting and subsequent silting or backfilling of a ditch may result in a larger volume of weakly magnetic material being accumulated in the trench compared to the undisturbed subsoil. A weak magnetic anomaly should therefore appear in plan along the line of the ditch.

The magnetic survey was carried out using a dual sensor Grad601-2 Magnetic Gradiometer manufactured by Bartington Instruments Ltd. The instrument consists of two fluxgates very accurately aligned to nullify the effects of the Earth's magnetic field. Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background. The Grad601-2 consists of two high stability fluxgate gradiometers suspended on a single frame. Each gradiometer has a 1m separation between the sensing elements so enhancing the response to weak anomalies.

3.4 Sampling interval, depth of scan, resolution and data capture

3.4.1 Sampling interval

Readings were taken at 0.25m centres along traverses 1m apart. This equates to 3600 sampling points in a full 30m x 30m grid.

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3.4.2 Depth of scan and resolution

The Grad 601-2 has a typical depth of penetration of 0.5m to 1.0m, though strongly magnetic objects may be visible at greater depths. The collection of data at 0.25m centres provides an optimum methodology for the task balancing cost and time with resolution.

3.4.3 Data capture

The readings are logged consecutively into the data logger which in turn is daily down-loaded into a portable computer whilst on site. At the end of each site survey, data is transferred to the office for processing and presentation.

3.5 Processing, presentation of results and interpretation

3.5.1 Processing

Processing is performed using specialist software. This can emphasise various aspects contained within the data but which are often not easily seen in the raw data. Basic processing of the magnetic data involves 'flattening' the background levels with respect to adjacent traverses and adjacent grids. Once the basic processing has flattened the background it is then possible to carry out further processing which may include low pass filtering to reduce 'noise' in the data and hence emphasise the archaeological or man-made anomalies.

The following schedule shows the basic processing carried out on all minimally processed gradiometer data used in this report:

1. *Destripe* (Removes striping effects caused by zero-point discrepancies between different sensors and walking directions)

2. *Destagger* (Removes zigzag effects caused by inconsistent walking speeds on sloping, uneven or overgrown terrain)

3.5.2 Presentation of results and interpretation

The presentation of the data for each site involves a print-out of the minimally processed data both as a greyscale plot (Figure 3) and a colour plot showing extreme magnetic values (Figure 4). Magnetic anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawing for the site (Figure 5).

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4 RESULTS

There has been very little found in the way of possible archaeological features. A weak positive linear anomaly appears towards the south of the survey area. This is however surrounded by strong magnetic anomalies which are interpreted as to made or disturbed ground and other variable readings which are probably associated with the underlying geology or pedology. The possible archaeological feature could therefore be linked to the ground clearance works or the rough terrain. More strong magnetic debris has been identified to the west where there is an area of compacted gravel. Magnetic disturbance associated with nearby ferrous objects appears around the north western and north eastern extremes of the survey area.

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5 REFERENCES

British Geological Survey, n.d., *website*: (http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps) Geology of Britain viewer.

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

APPENDIX A – Basic principles of magnetic survey

Detailed magnetic survey can be used to effectively define areas of past human activity by mapping spatial variation and contrast in the magnetic properties of soil, subsoil and bedrock.

Weakly magnetic iron minerals are always present within the soil and areas of enhancement relate to increases in *magnetic susceptibility* and permanently magnetised *thermoremanent* material.

Magnetic susceptibility relates to the induced magnetism of a material when in the presence of a magnetic field. This magnetism can be considered as effectively permanent as it exists within the Earth's magnetic field. Magnetic susceptibility can become enhanced due to burning and complex biological or fermentation processes.

Thermoremanence is a permanent magnetism acquired by iron minerals that, after heating to a specific temperature known as the Curie Point, are effectively demagnetised followed by re-magnetisation by the Earth's magnetic field on cooling. Thermoremanent archaeological features can include hearths and kilns and material such as brick and tile may be magnetised through the same process.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement allowing assessment and characterisation of subsurface features. Material such as subsoil and non-magnetic bedrock used to create former earthworks and walls may be mapped as areas of lower enhancement compared to surrounding soils.

Magnetic survey is carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically either 0.5 or 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field whilst the lower sensor measures the same field but is also more affected by any localised buried field. The difference between the two sensors will relate to the strength of a magnetic field created by a buried feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity, disturbance from modern services etc.

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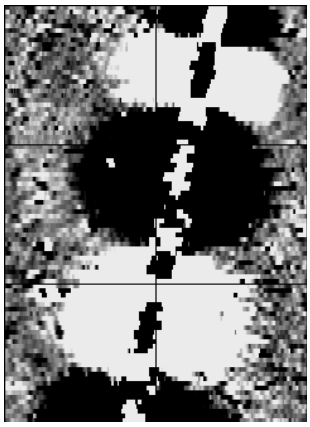
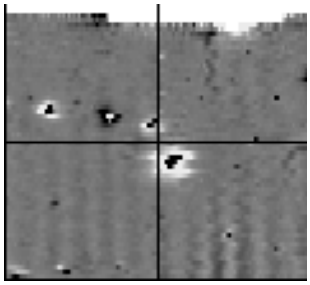
APPENDIX B – Glossary of magnetic anomalies

Bipolar



A bipolar anomaly is one that is composed of both a positive response and a negative response. It can be made up of any number of positive responses and negative responses. For example a pipeline consisting of alternating positive and negative anomalies is said to be bipolar. See also dipolar which has only one area of each polarity. The interpretation of the anomaly will depend on the magnitude of the magnetic field strength. A weak response may be caused by a clay field drain while a strong response will probably be caused by a metallic service.

Dipolar

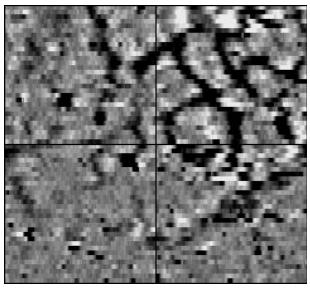


This consists of a single positive anomaly with an associated negative response. There should be no separation between the two polarities of response. These responses will be created by a single feature. The interpretation of the anomaly will depend on the magnitude of the magnetic measurements. A very strong anomaly is likely to be caused by a ferrous object.

Positive anomaly with associated negative response

See bipolar and dipolar.

Positive linear



A linear response which is entirely positive in polarity. These are usually related to in-filled cut features where the fill material is magnetically enhanced compared to the surrounding matrix. They can be caused by ditches of an archaeological origin, but also former field boundaries, ploughing activity and some may even have a natural origin.

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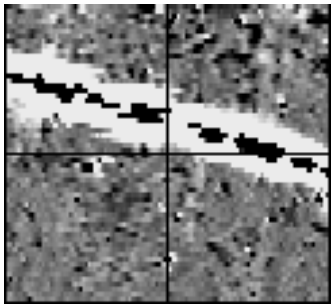
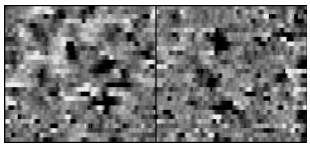
Positive linear anomaly with associated negative response



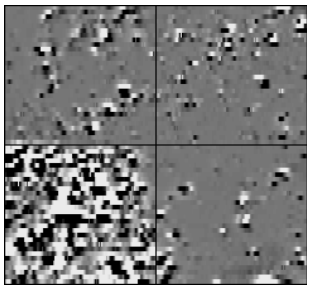
A positive linear anomaly which has a negative anomaly located adjacently. This will be caused by a single feature. In the example shown this is likely to be a single length of wire/cable probably relating to a modern service. Magnetically weaker responses may relate to earthwork style features and field boundaries.

Positive point/area



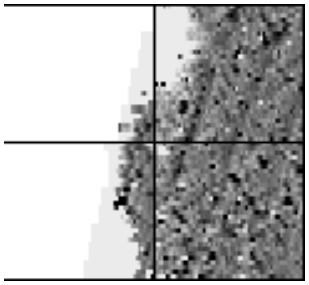
These are generally spatially small responses, perhaps covering just 3 or 4 reading nodes. They are entirely positive in polarity. Similar to positive linear anomalies they are generally caused by in-filled cut features. These include pits of an archaeological origin, possible tree bowls or other naturally occurring depressions in the ground.

Magnetic debris



Magnetic debris consists of numerous dipolar responses spread over an area. If the amplitude of response is low (+/-3nT) then the origin is likely to represent general ground disturbance with no clear cause, it may be related to something as simple as an area of dug or mixed earth. A stronger anomaly (+/-250nT) is more indicative of a spread of ferrous debris. Moderately strong anomalies may be the result of a spread of thermoremanent material such as bricks or ash.

Magnetic disturbance



Magnetic disturbance is high amplitude and can be composed of either a bipolar anomaly, or a single polarity response. It is essentially associated with magnetic interference from modern ferrous structures such as fencing, vehicles or buildings, and as a result is commonly found around the perimeter of a site near to boundary fences.

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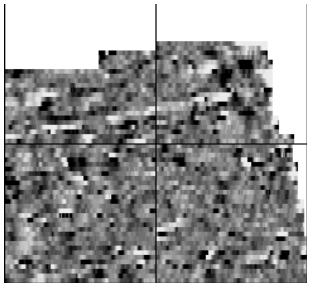
Negative linear

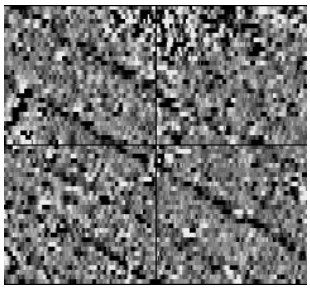


A linear response which is entirely negative in polarity. These are generally caused by earthen banks where material with a lower magnetic magnitude relative the background top soil is built up. See also ploughing activity.

Negative point/area

Opposite to positive point anomalies these responses may be caused by raised areas or earthen banks. These could be of an archaeological origin or may have a natural origin.

Ploughing activity



Ploughing activity can often be visualised by a series of parallel linear anomalies. These can be of either positive polarity or negative polarity depending on site specifics. It can be difficult to distinguish between ancient ploughing and more modern ploughing, clues such as the separation of each linear, straightness, strength of response and cross cutting relationships can be used to aid this, although none of these can be guaranteed to differentiate between different phases of activity.

Polarity

Term used to describe the measurement of the magnetic response. An anomaly can have a positive polarity (values above 0nT) and/or a negative polarity (values below 0nT).

Strength of response

The amplitude of a magnetic response is an important factor in assigning an interpretation to a particular anomaly. For example a positive anomaly covering a $10m^2$ area may have values up to around 3000nT, in which case it is likely to be caused by modern magnetic interference. However, the same size and shaped anomaly but with values up to only 4nT may have a natural origin. Colour plots are used to show the amplitude of response.

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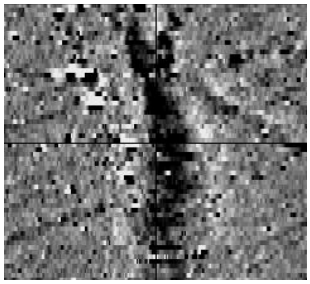
Thermoremanent response

A feature which has been subject to heat may result in it acquiring a magnetic field. This can be anything up to approximately +/-100 nT in value. These features include clay fired drains, brick, bonfires, kilns, hearths and even pottery. If the heat application has occurred in situ (e.g. a kiln) then the response is likely to be bipolar compared to if the heated objects have been disturbed and moved relative to each other, in which case they are more likely to take an irregular form and may display a debris style response (e.g. ash).

Weak background variations



Weakly magnetic wide scale variations within the data can sometimes be seen within sites. These usually have no specific structure but can often appear curvy and sinuous in form. They are likely to be the result of natural features, such as soil creep, dried up (or seasonal) streams. They can also be caused by changes in the underlying geology or soil type which may contain unpredictable distributions of magnetic minerals, and are usually apparent in several locations across a site.

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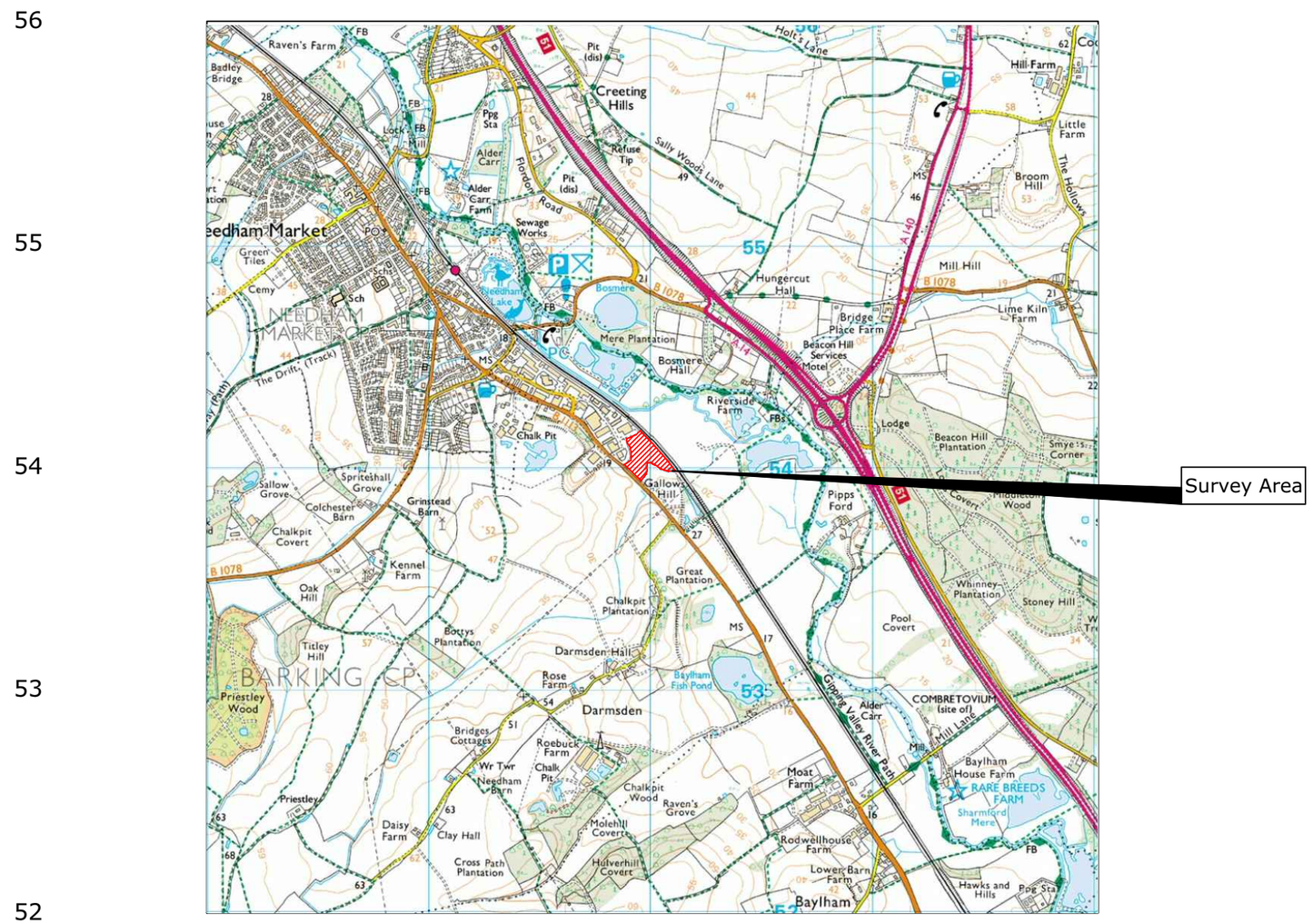
OS 100km square = TM



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

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Site centred on NGR TM 100 540

Client
SUFFOLK COUNTY COUNCIL

Project Title — Job No. 3019
NEEDHAM MARKET, SUFFOLK

Subject
LOCATION PLAN OF SURVEY AREA

STRATASCAN™
GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING
VINEYARD HOUSE
UPTON UPON SEVERN
WR8 0SA
T: 01684 592266
E: info@stratascan.co.uk
www.stratascan.co.uk

SUMO GROUP MEMBER

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Survey date	Drawn by	Figure No.
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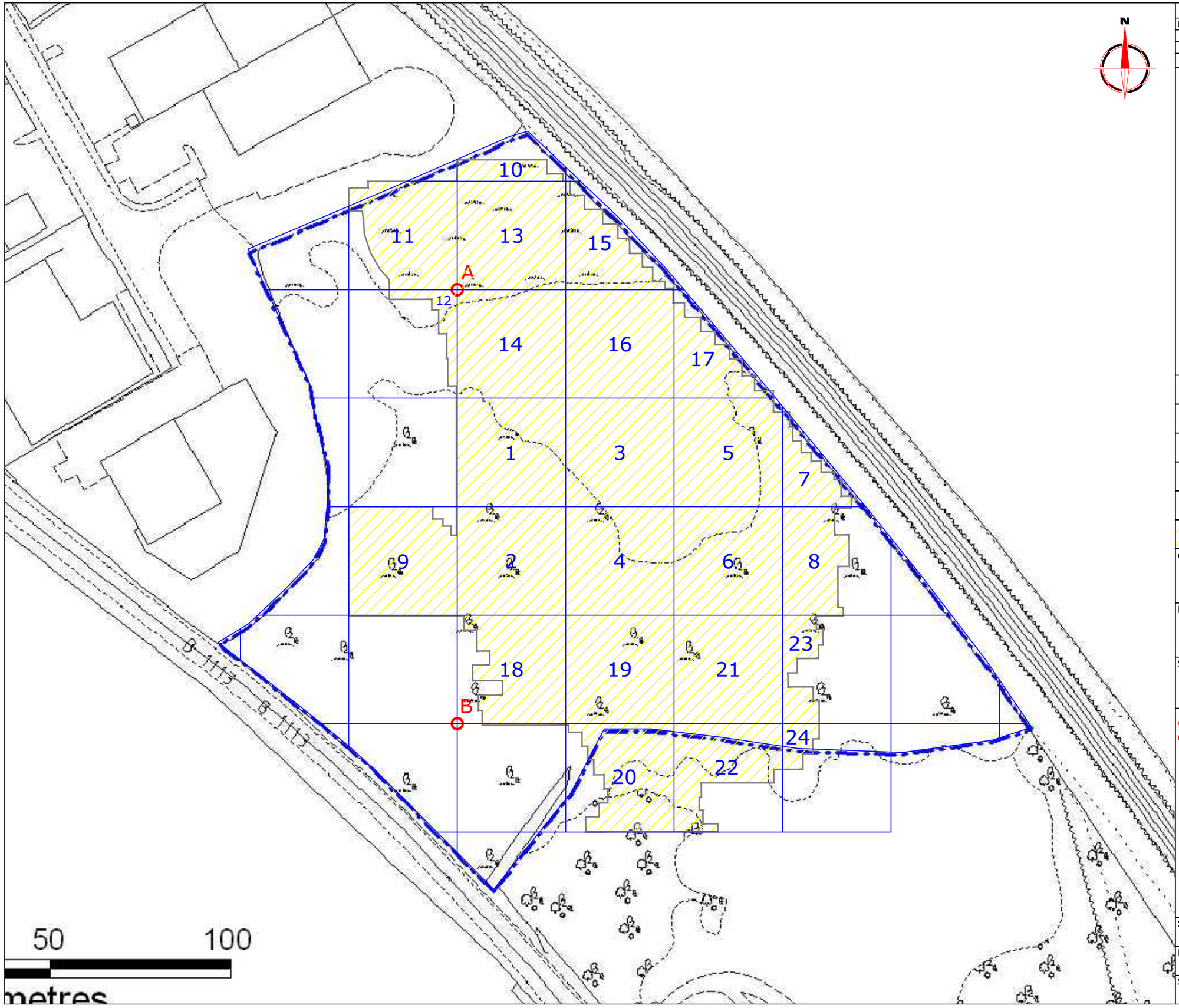

Amendments

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OS GRID REFERENCES

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B	609946.35,253989.87

KEY

1	SURVEY GRID
	SURVEYED AREA

Client

SUFFOLK COUNTY COUNCIL

Project Title — Job No. 3019

NEEDHAM MARKET, SUFFOLK

Subject

LOCATION OF SURVEY GRIDS AND REFERENCING

STRATASCAN™
GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING
VINEYARD HOUSE
UPTON UPON SEVERN
WR8 0SA
T: 01684 592266
E: info@stratascan.co.uk
www.stratascan.co.uk

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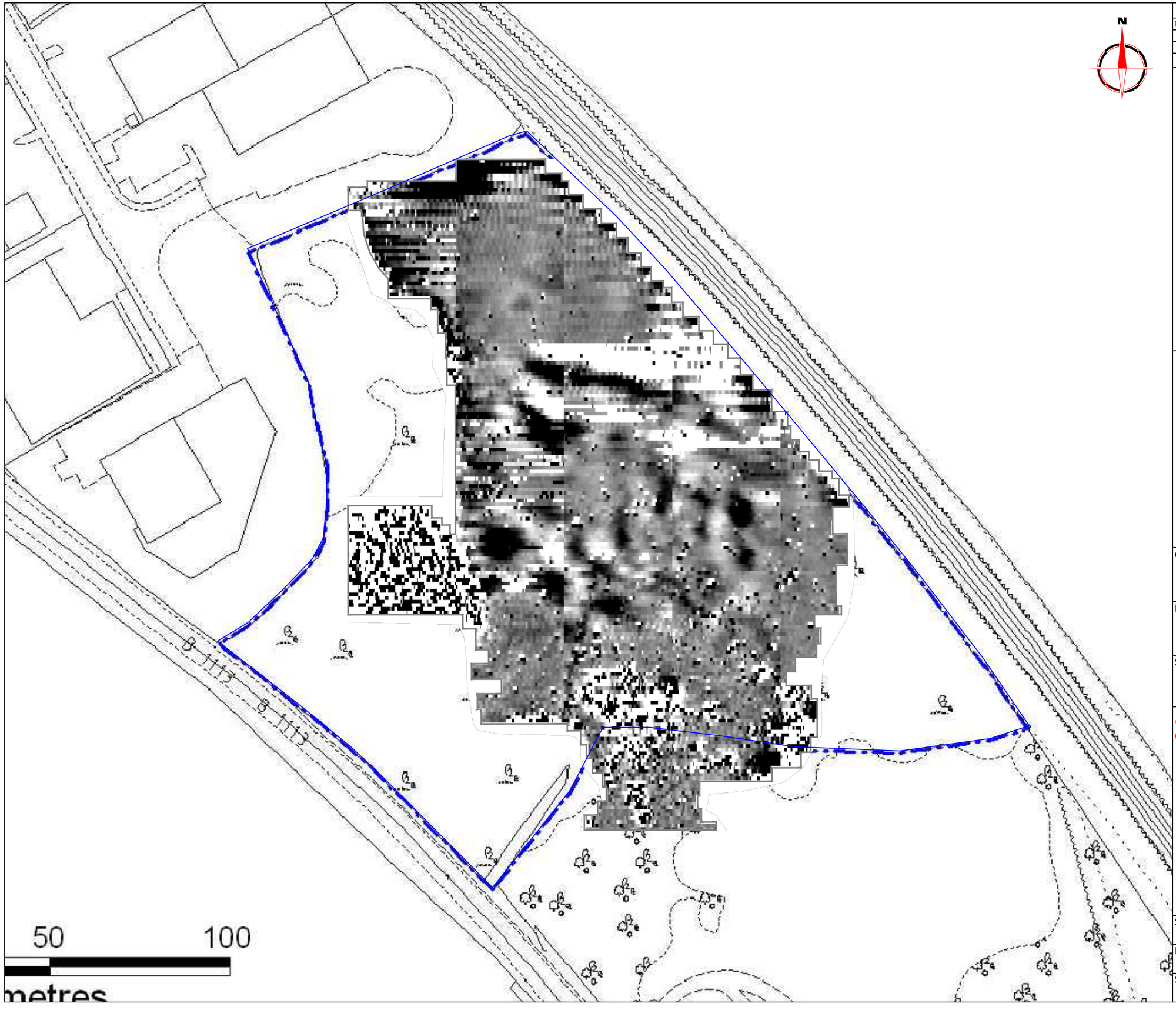

Amendments

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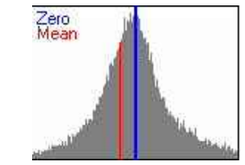
Plotting parameters

Maximum +3nT (black)
Minimum -3nT (white)



Client

SUFFOLK COUNTY COUNCIL

Project Title — Job No. 3019

NEEDHAM MARKET, SUFFOLK

Subject

PLOT OF MINIMALLY PROCESSED GRADIOMETER DATA

STRATASCAN™
GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING
VINEYARD HOUSE
UPTON UPON SEVERN
WR8 0SA
T: 01684 592266
E: info@stratascan.co.uk
www.stratascan.co.uk

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DEC 2011	MB	3

Amendments

Issue No.	Date	Description
-	-	-
-	-	-

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Plotting parameters

Maximum +250nT (red)
Minimum -250nT (blue)

+250nT

-250nT

Client

Project Title

Job No. 3019

NEEDHAM MARKET, SUFFOLK

Subject

COLOUR PLOT OF GRADIOMETER DATA SHOWING EXTREME VALUES

STRATASCAN™
GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING
VINEYARD HOUSE
UPTON UPON SEVERN
WR8 0SA
T: 01684 592266
E: info@stratascan.co.uk
www.stratascan.co.uk

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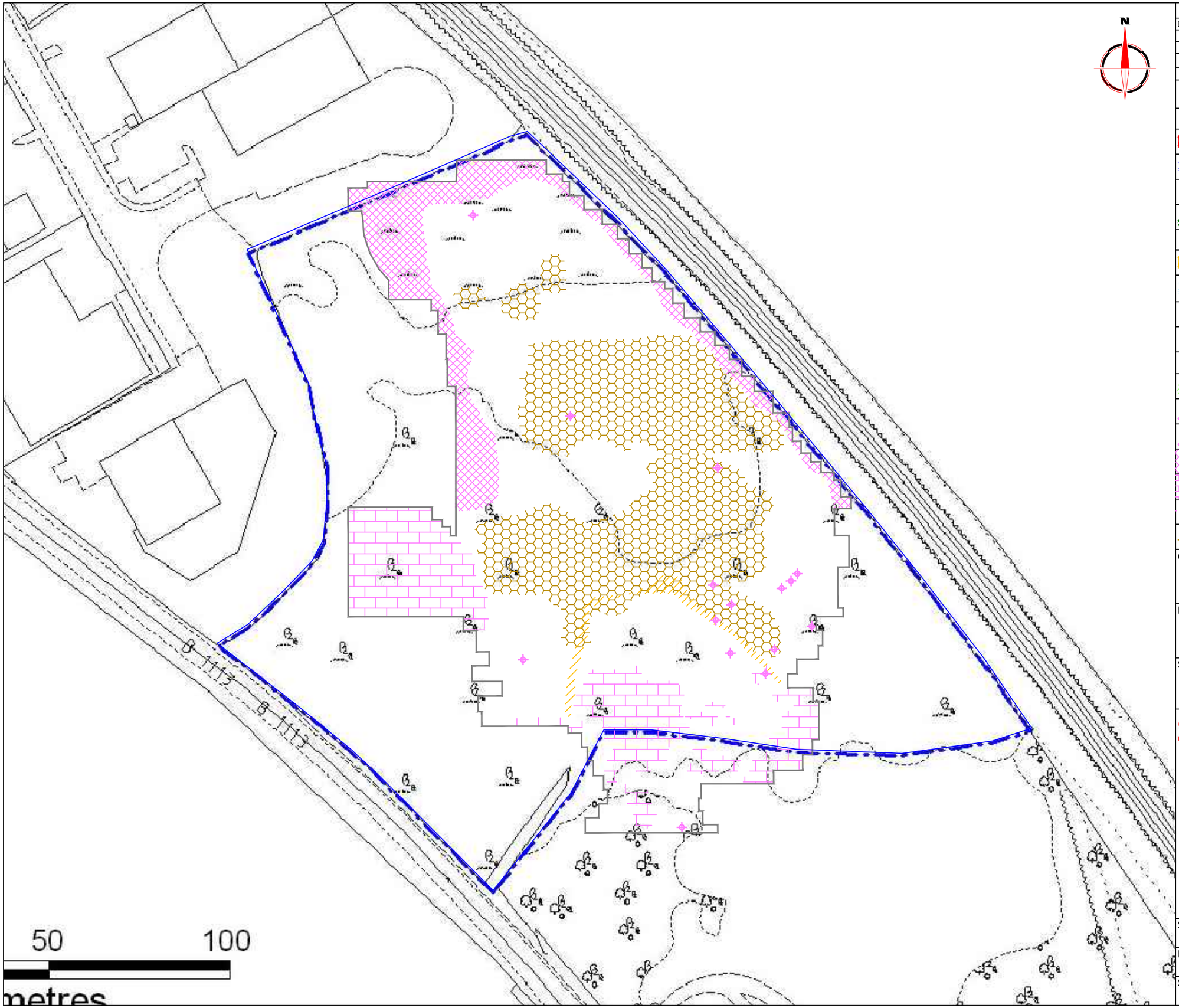

Amendments

Issue No.	Date	Description
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-	-	-

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KEY

PROBABLE ARCHAEOLOGY

- Positive anomaly / weak positive anomaly - probable cut feature of archaeological origin
- Negative anomaly / weak negative anomaly - probable bank or earthwork of archaeological origin
- Moderate strength discrete anomaly - probable thermoremanent feature
- Widely spaced curving parallel linear anomalies - probably related to ridge-and-furrow

POSSIBLE ARCHAEOLOGY

- Positive anomaly / weak positive anomaly - possible cut feature of archaeological origin
- Negative anomaly / weak negative anomaly - possible bank or earthwork of archaeological origin
- Moderate strength discrete anomaly - possible thermoremanent feature
- Magnetic spike - probable ferrous object

OTHER ANOMALIES

- Closely spaced parallel linear anomalies - probably related to agricultural activity such as ploughing
- Linear anomaly - probably related to pipe, cable or other modern service
- Linear anomaly - possibly related to land drain
- Magnetic disturbance associated with nearby metal object such as service or field boundary
- Strong magnetic debris - possible disturbed or made ground
- Scattered magnetic debris
- Area of amorphous magnetic variation - probable natural (e.g. geological or pedological) origin

Client

SUFFOLK COUNTY COUNCIL

Project Title — Job No. 3019

NEEDHAM MARKET, SUFFOLK

Subject

ABSTRACTION AND INTERPRETATION OF GRADIOMETER ANOMALIES

STRATASCAN™
GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING
VINEYARD HOUSE
UPTON UPON SEVERN
WR8 0SA
T: 01684 592266
E: info@stratascan.co.uk
www.stratascan.co.uk

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