Geophysical Survey Report

of

Cambridge South East Transport Phase 2

For

Cambridge Archaeological Unit

On Behalf Of

Greater Cambridge Partnership

Magnitude Surveys Ref: MSTL609

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Abstract

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a c.69.3 ha area of land as part of Phase 2 of the Cambridge Southeast Transport Project. Access could not be arranged for c.2.0 ha of the corridor. A fluxgate gradiometer survey was successfully completed across the site. The geophysical survey has primarily detected anomalies related to archaeological, agricultural and modern activity. Archaeological activity has been identified in the form of trackways, enclosures, and anomalies interpreted as pits. Anomalies related to historical agricultural use have been detected in the form of ridge and furrow cultivation, former field boundaries, and field drains, as well as modern agricultural trends. Further historic activity relates to mapped World War II anti-tank trenches in the centre of the survey area, and a former railway in the south. Natural variations have also been identified, corresponding with dissolution patterns of the calcareous bedrock and runoff features in the near surface relating to site topography. The impact of modern activity on the results is mostly limited to anomalies related to extant field boundaries and an underground service.

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1. Introduction

1.1. Magnitude Surveys Ltd (MS) was commissioned by Cambridge Archaeological Unit on behalf of the Greater Cambridge Partnership. The survey area comprised a linear corridor of c.69.3 ha of land (access could not be arranged for c.2.0 ha of the corridor) as part of Stage 1 of the Cambridge Southeast Transport Project, from Great Shelford, Cambridgeshire to Babraham, Cambridgeshire (TL45965438 in the north to TL50714952 in the south).

1.2. The geophysical survey comprised hand-carried GNSS-positioned fluxgate gradiometer survey.

1.3. The survey was conducted in line with the current best practice guidelines produced by Historic England (David et al., 2008), the Chartered Institute for Archaeologists (CIfA, 2014) and the European Archaeological Council (Schmidt et al., 2015).

1.4. It was conducted in line with a WSI produced by MS (Magnitude Surveys, 2019).

1.5. The survey commenced on 20/01/20 and took nine days to complete.

2. Quality Assurance

2.1. Magnitude Surveys is a Registered Organisation of the Chartered Institute for Archaeologists (CIfA), the chartered UK body for archaeologists, and a corporate member of ISAP (International Society of Archaeological Prospection).

2.2. Director Dr. Chrys Harris is a Member of CIfA, has a PhD in archaeological geophysics from the University of Bradford and is the Vice-Chair of ISAP. Director Finnegan Pope-Carter is a Fellow of the London Geological Society, the chartered UK body for geophysicists and geologists, as well as a member of GeoSIG, the CIfA Geophysics Special Interest Group. Reporting Analyst Dr. Kayt Armstrong has a PhD in archaeological geophysics from Bournemouth University, is the Vice Conference Secretary and Editor of ISAP News for ISAP, and is the UK Management Committee representative for the COST Action SAGA.

2.3. All MS managers have relevant degree qualifications to archaeology or geophysics. All MS field and office staff have relevant archaeology or geophysics degrees and/or field experience.

3. Objectives

3.1. The objective of this geophysical survey is to determine, the location, extent, character, and significance of any potential archaeological remains likely to be threatened by the proposed development and geomorphological anomalies that might inform on the nature of human activity at the site.

3.2. The geophysical survey results will be used to inform a future trench-based evaluation to ground truth the results.

4. Geographic Background

4.1. The northern extent of the survey area is located 4.2km south-southeast of Cambridge, north of Great Shelford, and extends a further c.7km southeast, ending east of Sawston (Figure 1). Survey was undertaken across ten fields under arable conditions. The site is a narrow corridor passing through the centre of fields, as such it is mostly bounded by further arable land, split by some trackways and small roads. In the northern section a railway line bounded the west of the corridor. Access could not be arranged for c.2.0 ha of the corridor, which was located north of Sawston.

4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	The area consisted of an arable stubble field. The area was generally flat, with a gentle slope upwards to the northwest in the northwestern corner of the field.	Bounded to the northwest by a metal fence, cycle path and train line. Bounded to northeast and southeast by hedges. The field continued on all other sides.
2	The area consisted of a flat arable stubble field.	Bounded to the north and west by a footpath/track and cycle path, to the northeast by a hedge. The field continued to the east and the south was bounded by a footpath/track and a ditch.
3	The area consisted of a flat grass field.	The field was bounded to the west by a private road, by further fields to the northwest and east, and by trees to the southwest.
4	The area consisted of an arable stubble field, sloping down to the southeast.	The field was bounded to the northwest and southeast by hedgerow and the field continued to the southwest and northwest.
5	The area consisted of an arable stubble field with a slight slope down to the southwest and a rise at the southeast end of the field.	The field continued to the north and east, with the survey area bounded by hedgerow to the south and southwest and bounded by a road to the west.
6	The area consisted of a flat arable young wheat crop.	Bounded to the north by a hedgerow, and a gravel track to the south. The field continued to the northeast and southwest
7	The area consisted of a flat arable field.	Bounded to the south by a bank. The field continued to the north and west.
8	The area consisted of a flat arable field.	The survey area was bounded by a path to the north-west, a wire fence to the SW and S (beyond which was a construction site) and the field continued to the north and east. The eastern boundary was formed by a change in use of land. Tractor tracks were present running southwest to northeast at intervals across the survey area.
9	The area consisted of an arable stubble field. The area was flat in the western half; the eastern half of the site sloped down towards the southeast corner and the centre-south of the field. A few small boggy areas could not be surveyed in the southeast.	The field continued to the northeast and northwest. The survey area was bounded to the southeast by hedges, trees and a wire fence, and to the southwest by hedges. Metal poles were present along the field boundary in the centre-south. The area was bounded to the east and west by the bank of a road, with the western bank also having trees and hedges. A raised bank was present in the centre-east of the survey area, running roughly north to south and dividing the field in two. A few tractor tracks were noted running on various orientations across the survey area. Telephone poles were present at the centre-north of the survey area and overhead cables ran west to east across the centre-north of the field.
10	The area consisted of an arable field. A large hill was present in the centre of the survey area that sloped down and outwards in all directions. The hill flattened out in the north of the survey area.	The field continued to the east and west of the survey area. Bounded by a hedge to the north and south. Two piles of rubble were present in the centre-south of the survey area and two wire fences ran southwest to northeast across the field at its northernmost end, creating a separate field within the survey area.

4.3. The bedrock geology across the majority of the site is Zig Zag Chalk Formation transitioning to West Melbury chalk formation in the northern area, and the Holywell nodular chalk formation in the south. No superficial deposits have been identified across most of the survey area; however, two small areas of river terrace deposits, sand and gravels, have been identified - one in the centre of the linear corridor and the other in far southern extent (British Geological Survey, 2020).

4.4. The soils consist of freely draining lime-rich loamy soils over the majority of the site, with pockets of shallow lime-rich soils over chalk or limestone in the north and centre of the survey area (Soilscapes, 2019).

5. Archaeological Background

5.1. The following is a summary of a Brief for Archaeological Evaluation produced by Cambridgeshire Historic Environment Team (2019) and a Technical Note produced by Mott Macdonald (2019).

5.2. A range of prehistoric activity has been recorded within the wider environs of the site including a Neolithic shaft, a Bronze Age ring ditch, an Early Bronze Age use of natural hollows, Middle to Late Bronze Age roundhouse, pits and postholes, Late Bronze Age/Early Iron Age four-poster building, possible building eaves drip gullies and a late Iron Age cremation were found. Bronze Age barrows were also recorded in Fourwentways at the site of the existing hotel to the east of the A11. At Bourn Bridge, to the west of the A11, a borrow pit and a Bronze Age ring ditch were found along with Mesolithic and Neolithic activity (CHER 11317). Two isolated prehistoric pits were found at Dale Manor. Near Babraham Road Park and Ride, late prehistoric pits, Late Bronze Age/Early Iron Age ring ditches, Late Neolithic/Early Bronze Age pit cluster and an Iron Age well were discovered. Also, the presence of Copley Hill long barrow and enclosures (NHLE

1020845), Little Trees causewayed enclosure and bowl barrow (NHLE 1011717) and Wandlebury Iron Age hillfort (NHLE 1009395) in the vicinity must be taken into consideration.

5.3. Late Iron age/Roman activity has been identified in the area as very different types of activities such as the Worsted Street Roman Road (NHLE 1003263), a Romano-British settlement located in Granhams Farm; a Late Iron Age/Roman field system (CHER 11317C) and a Roman settlement and droveway (CHER 11317D) were identified at Bourn Bridge. Roman boundary ditches, enclosures and trackways, pits and postholes, as well as a juvenile burial were found during the excavations at Dale Manor. An Early Roman field system and kiln (CHER MCB26679); Iron Age/Roman enclosures (CHER 08339), Late Iron Age enclosure, recut during the Early Roman period, a Roman ditch (CHER MCB20378) and Early Roman, post holes, beam slots ditches and a midden (CHER MCB19991) were found to the east of Trumpington.

5.4. Medieval and post-medieval activity in the area has been identified as Post-medieval pits and enclosure ditches predating the Act of Inclosure and an anti-tank trench located at Granhams Farm and at Bourn Bridge, a Saxon settlement and find (CHER 13044, CHER CB14745) and ditches associated with Babraham water meadows have been excavated.

6. Methodology

6.1. Data Collection

6.1.1. Geophysical prospection comprised the magnetic method as described in the following table.

6.1.2. Table of survey strategies:

Method	Instrument	Traverse Interval	Sample Interval
Magnetic	Bartington Instruments Grad-13 Digital Three-Axis Gradiometer	1m	200Hz reprojected to 0.125m

6.1.3. The magnetic data were collected using MS' bespoke hand-carried GNSS-positioned system.

6.1.3.1. MS' hand-carried system was comprised of Bartington Instruments Grad 13 Digital Three-Axis Gradiometers. Positional referencing was through a multi-channel, multi-constellation GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The RTK GPS is accurate to 0.008m + 1ppm in the horizontal and 0.015m + 1ppm in the vertical.

6.1.3.2. Magnetic and GPS data were stored on an SD card within MS' bespoke datalogger. The datalogger was continuously synced, via an in-field Wi-Fi unit, to servers within MS' offices. This allowed for data collection, processing and visualisation to be monitored in real-time as fieldwork was ongoing.

6.1.3.3. A navigation system was integrated with the RTK GPS, which was used to guide the surveyor. Data were collected by traversing the survey area along the longest possible lines, ensuring efficient collection and processing.

6.2. Data Processing

6.2.1. Magnetic data were processed in bespoke in-house software produced by MS. Processing steps conform to Historic England's standards for "raw or minimally processed data" (see sect 4.2 in David et al., 2008: 11).

Sensor Calibration – The sensors were calibrated using a bespoke in-house algorithm, which conforms to Olsen et al. (2003).

Zero Median Traverse – The median of each sensor traverse is calculated within a specified range and subtracted from the collected data. This removes striping effects caused by small variations in sensor electronics.

Projection to a Regular Grid – Data collected using RTK GPS positioning requires a uniform grid projection to visualise data. Data are rotated to best fit an orthogonal grid projection and are resampled onto the grid using an inverse distance-weighting algorithm.

Interpolation to Square Pixels – Data are interpolated using a bicubic algorithm to increase the pixel density between sensor traverses. This produces images with square pixels for ease of visualisation.

6.3. Data Visualisation and Interpretation

6.3.1. This report presents the gradient of the sensors' total field data as greyscale images, as well as the total field data from the lower sensors. The gradient of the sensors minimises external interferences and reduces the blown-out responses from ferrous and other high contrast material. However, the contrast of weak or ephemeral anomalies can be reduced through the process of calculating the gradient. Consequently, some features can be clearer in the respective gradient or total field datasets. Multiple greyscale images at different plotting ranges have been used for data interpretation. Greyscale images should be viewed alongside the XY trace plot (Figures 14, 17, 20, 23, 26, 29, 32, 25, 38, 41). XY trace plots visualise the magnitude and form of the geophysical response, aiding in anomaly interpretation.

6.3.2. Geophysical results have been interpreted using greyscale images and XY traces in a layered environment, overlaid against open street maps, satellite imagery, historic maps, LiDAR data, and soil and geology maps. Google Earth (2019) was consulted as well, to compare the results with recent land usages.

6.3.3. Geodetic position of results - All vector and raster data have been projected into OSGB36 (ESPG27700) and can be provided upon request in ESRI Shapefile (.SHP) and Geotiff (.TIF) respectively. Figures are provided with raster and vector data projected against OS Open Data.

7. Results

7.1. Qualification

7.1.1. Geophysical results are not a map of the ground and are instead a direct measurement of subsurface properties. Detecting and mapping features requires that said features have properties that can be measured by the chosen technique(s) and that these

properties have sufficient contrast with the background to be identifiable. The interpretation of any identified anomalies is inherently subjective. While the scrutiny of the results is undertaken by qualified, experienced individuals and rigorously checked for quality and consistency, it is often not possible to classify all anomaly sources. Where possible an anomaly source will be identified along with the certainty of the interpretation. The only way to improve the interpretation of results is through a process of comparing excavated results with the geophysical reports. MS actively seek feedback on their reports as well as reports of further work in order to constantly improve our knowledge and service.

7.2. Discussion

7.2.1. The geophysical results are presented in consideration with satellite imagery and historic maps (Figures 5, 8 and 11).

7.2.2. The fluxgate gradiometer survey has responded well to the environment of the survey area. The chalk geology, coupled with the thin soil has given rise to a relatively quiet magnetic background, against which more ephemeral features of archaeological, agricultural and natural anomalies related to the erosion properties of the chalk have been identified. Anomalies related to WWII anti-tank trenches have also been identified. Modern interference on the results is limited and relates to a construction site in the southernmost part of the survey area, modern field boundaries and buried services. The geophysical survey has primarily detected archaeological and agricultural anomalies, along with anomalies relating to mapped and unmapped WWII anti-tank trenches (Council for British Archaeology, Defence of Britain, 2006).

7.2.3. The majority of the archaeological activity detected within the survey area occurs in the northern section, where a complex of rectilinear and curvilinear enclosures abuts two trackways. The position and orientation of these trackways suggests they may have converged to the southeast, however a modern service line masks this possible area of convergence (Figure 16). The enclosures extending from both trackways have elements which overlap both each other, and in some instances the trackways themselves. This indicates possible multi-phase activity in this area. Within the northern enclosure complex, anomalies typical of pits have been identified. The narrow context which the survey corridor provides has limited interpretation somewhat, as it appears as though the archaeological activity extends beyond the bounds of the survey area. However, the anomalies detected are indicative of an Iron Age - Romano-British occupation zone, which is in keeping with the archaeological activity of the region (see section 5.3). Isolated sections of positive linear anomalies occur further to the south, perhaps suggesting wider landscape divisions predating available historic maps (Figures 4, 7, & 10). In addition, a possible partial ring ditch has also been detected, close to the centre of the survey area (Figure 28).

7.2.4. Agricultural activity has been detected across the survey area, mainly appearing as linear ploughing trends, and as well as instances repeated tractor movement, or tractor tracks. Anomalies have been detected reflecting changes of land usage such as former

field boundaries. Further linear trends have been identified relating to drainage features.

7.2.5. In the southern section, a band of strongly ferrous debris material has been detected which corresponds with a former railway present on historic maps (Figure 11).

7.3. Interpretation

7.3.1. General Statements

7.3.1.1. Geophysical anomalies will be discussed broadly as classification types across the survey area. Only anomalies that are distinctive or unusual will be discussed individually.

7.3.1.2. **Natural (Strong, Weak and Spread)** – Although the survey area is comprised of three bedrock formations (see section 4.3) a number of different processes and variations can be discerned (Figures 15, 18, 27, 30, 36). The chalk beds underlying the survey area are a highly biogenic material and are thus susceptible to dissolution from precipitates percolating through the thin (c.0.2-0.5m) soil layers present above them. This manifests as amorphous positively enhanced bands in the background of the data, which reflects differences in the soil thickness and the subsurface morphology. Natural variations of a more linear form relate to the site topography and hydrology, with evidence of rills / hill wash in the centre of the survey area (Figure 25). Broader, more spread variations are attributed to fans of hill wash material being deposited as the base of both extant and subsurface slopes.

7.3.1.3. **Agricultural (Trend)** – Modern ploughing trends have been detected throughout the survey area (Areas 4 , 5 , 6, 7, and 9), presenting as weakly positive linear anomalies. The close, regular spacing and straight form of these anomalies differentiates them from historic ploughing regimes. These anomalies often correspond with ploughing visible on recent satellite images (Figures 5, 8 and 11).

7.3.1.4. **Magnetic Disturbance** – The strong anomalies produced by extant metallic structures along the edges of the field and by buried services have been classified as 'Magnetic Disturbance'. These magnetic 'haloes' will obscure the response of any weaker underlying features, should they be present, often over a greater footprint than the structure they are being caused by.

7.3.1.5. **Ferrous (Spike)** – Discrete ferrous-like, dipolar anomalies are likely to be the result of isolated modern metallic debris on or near the ground surface.

7.3.1.6. **Ferrous/Debris (Spread)** – A ferrous/debris spread refers to a concentrated deposition of discrete, dipolar ferrous anomalies and other highly magnetic material.

7.3.1.7. **Undetermined** – Anomalies are classified as Undetermined when the anomaly origin is ambiguous through the geophysical results and there is no supporting or correlative evidence to warrant a more certain classification. These

anomalies are likely to be the result of geological, pedological or agricultural processes, although an archaeological origin cannot be entirely ruled out. Undetermined anomalies are generally not ferrous in nature.

7.3.2. Magnetic Results - Specific Anomalies

Northern Section (Figures 12-20)

7.3.2.1. **Archaeology Probable (Strong and Weak) –** Two parallel linear anomalies have been detected running through the north of Area 3 into the south of Area 1 **[1a/3a]** (Figure 16). The parallel linear anomalies follow a northwest to southeast alignment, with a separation of 7m. The continuous weakly positive, magnetic signal is typical of ditch-type anomalies and it is likely that **[1a/3a]** is representative of ditches bounding a trackway. Similar anomalies have been identified to the south, contained solely within Area 1 [**1b**], which have a weaker magnetic signal (Figure 16). At their northern end [**1b**], the anomalies change characteristics becoming a single ditched linear anomaly suggesting a change in use, possibly to a boundary rather than a trackway.

7.3.2.2. **Archaeology Probable (Strong and Weak) –** At the southern end of the possible trackway [**1b**], a large rectangular three-sided, enclosure has been identified [**1c**] (Figure 15). Formed from three strongly enhanced ditch-like anomalies, the eastern boundary of [**1c**] appears to have a clear opening, and the northern boundary merges with the northern ditch of the trackway [**1a**]. Three discrete positive anomalies located close to the northern boundary of [**1c**] have magnetic signals typical of pit-like anomalies. Whether these pit-like anomalies are related to the enclosure [**1c**] or the trackway [**1a**] is uncertain, due to their overlapping extents. This overlapping of features may indicate a multiphase period of occupation at the site.

7.3.2.3. **Archaeology Probable (Strong and Weak) –** North of trackway **[1b] t**wo small interlocking D-shaped enclosures have been identified, **[1d, 1e]** (Figure 16). Both enclosures are partly discontinuous; however, **[1e]** appears to have a deliberate opening within its eastern boundary, evidenced by a strong negative enhancement which suggests an entrance and not fragmentation created by later cultivation. These D-shaped enclosures are further enclosed within a weakly positive curvilinear anomaly, [**1f**], which appears to terminate at the boundary between Area 1 and Area 3. Enclosure [**1e**] overlaps with the eastern extent of [**1f**] further signifying likely multi-phase activity.

7.3.2.4. **Archaeology Probable (Strong and Weak) –** In the north of Area 3, strong linear anomalies have been identified extending north and south of trackway **[3a]** (Figure 16). The narrow context of the survey corridor prevents the full extent of these anomalies from being identified; however, it is likely these formed enclosures which bordered the trackway. The largest potential enclosure in the north **[3b]** appears to have an entrance on the eastern boundary (similar to enclosures **[1c]** and **[1e]**). To the south of the trackway two smaller potential enclosures **[3c]** and **[3d]** have been identified. The southern boundaries of

these enclosures presumably lie beneath a farm track and field boundary separating areas 1 and 3. No clear openings are present for these southern enclosures, and the linear anomalies representing the east and west boundary ditches extend to cross trackway **[3a],** ending at the northern trackway ditch.

7.3.2.5. **Archaeology Probable (Strong/ Zone) –** In the north of Area 3 numerous discrete, strong positive anomalies have been detected exhibiting magnetic signals typical of pits **[3e]**. These pit-like anomalies are present in clusters within and around enclosure **[3c]**, and in the north of trackway **[3a]**. These anomalies are likely of archaeological provenance, having magnetic signals of similar strength to the probable ditch features.

7.3.2.6. **Agricultural (Weak)/ Ridge and Furrow** – A weak linear anomaly on the southern edge of Area 1 collocates with a former field boundary denoted on 2nd edition OS maps (Figure 5). West of the former field boundary**,** but following the same northeast to southwest alignment, a series of parallel linear anomalies have been identified, **[1g]** and **[3f]**. These parallel linear anomalies are relatively widely spaced, between 5-8m separation, and have a slightly curved form (Figures 15 and 16) typical of ridge and furrow cultivation. In the centre of Area 1 the ridge and furrow cultivation appears to respect the boundary of the trackway **[1b]** which may indicate a contemporaneous existence.

7.3.2.7. **Burnt / Fired Material -** Exhibiting a strong magnetic enhancement **[1l]**, might indicate an area of burnt/ fired material. The characteristic shape and strength of these signals in the XY trace plots is suggestive of a high temperature burning process (Figures 15 & 17).

7.3.2.8. **Service** – A strong dipolar, linear anomaly **[1j]** has been detected aligned northwest to southeast in the south of Area 1 (Figure 15). This type of magnetic signal is typical of a buried service.

Centre Section (Figures 21-32)

7.3.2.1. **World War Two Defences** – In the north and south of Area 10, as well as across the centre of Area 5 (Figures 22, 25, 28), strong positively enhanced linear anomalies have been detected, **[5b, 10b, 10e]**. These linear anomalies have continuous, typical ditch-like magnetic signals. The linear anomalies each cross the entire width of their respective survey areas, and measure between 2-3m wide. Each of these anomalies corresponds with a recorded anti-tank trench on the Defence of Britain database (Council for British Archaeology, Defence of Britain, 2006).

7.3.2.2. **Possible Archaeology (Strong and Weak) –** Three linear anomalies have been detected in the north of Area 10, with **[10a]** running parallel to **[10b]** for a distance c.92m in a westerly direction (Figure 22). **[10c]** and **[10d]** run perpendicular to both **[10a]** and **[10b]**. Similarities in magnetic signal and orientation suggest some relationship between these features; however, none have been recorded in old maps of this area. The anomalies could relate to un-

mapped military defences introduced during the mid-20th century (see 7.3.2.11.).

7.3.2.3. **Possible Archaeology (Strong)** - In the west of Area 5, a circular anomaly has been identified **[5a]** (Figure 28). This circular anomaly has a relatively strong magnetic signal and defined edges, making it distinct from the other weaker and more diffuse curvilinear anomalies classified as "natural" in the area. **[5a]** measures c.20m in diameter and is considered to be of possible archaeological origin, possibly a ring ditch feature. The interpretation of this anomaly is complicated somewhat by its location on the edge of Area 5's southwest boundary, which appears to cut off the southern edge of the circular feature.

7.3.2.4. **Probable Archaeology** – In the north of Area 6 a rectangular three-sided enclosure, similar to that c.2.3km northwest at [**1c**] (see section 7.3.2.2), has been identified [**6a**] (Figures 27 & 28). Unlike that in Area 1, the magnetic signal of the enclosure in Area 6 is much weaker, and it has no associated trackway or visible entrance (other than the absent northwest boundary). However, a potential internal pit-like anomaly has been identified, in the form of a strong positive anomaly in the southeast of the enclosure.

Southern Section (Figures 33-41)

7.3.2.5. **Former Railway** – Along the southern edge of Areas 7,8 and 9 (Figures 34, 37 and 40) a band of noisy irregular dipolar anomalies has been interpreted as debris containing ferrous material has been identified **[7a]**, **[8a]**, **[9a]**. This band of anomalies runs for c.1.2km in a northwest-southeast direction corresponding with the route of a former railway on 2nd edition OS maps (Figure 11). Within this band of debris two parallel linear anomalies are visible within the gradient data (Figures 33, 36 and 39) which may represent the former location of the track. It is possible that the debris within Area 8 has been further enhanced by the presence of a construction site which borders the southwest of the area.

7.3.2.6. **Agricultural (Trend)** – In Areas 7 and 8 distinct "double linear" anomalies have been detected **[7b, 8b]** (Figure 34). Each pair of features are c.30m apart from one another and have a weak positive magnetic response, differing from previous ploughing seen and it can be seen clearly in the gradient data along a northeast-southwest alignment (Figure 33). This pattern is typical of modern tractor tracks in regularly ploughed fields.

7.3.2.7. **Agricultural (Strong/ Weak)** – Towards the south of Area 9, a strongly positive linear anomaly, **[9b],** has been identified (Figures 39 and 40). This linear anomaly spans the width of Area 9 on a sub north-south alignment. At the time of survey, a grass embankment was present at this location (visible on Figure 11) used as a land division and for the positioning of telegraph poles.

8. Conclusions

8.1. A fluxgate gradiometer survey has successfully been undertaken across the majority of the survey area, only c. 2ha could not be surveyed due to access issues. The geophysical survey has detected a range of different types of anomalies of archaeological, natural, agricultural and modern origin. The survey area has been impacted by natural variations related to surface relief and characteristic irregular erosional processes related to the chalk bedrock. However, overall, the magnetic enhancement of the survey area is relatively quiet which has aided the interpretation of weaker, more ephemeral features of archaeological and agricultural origin. Modern activity across the survey area is mostly limited to the perimeters of fields, in the form of broad ferrous anomalies; however, one buried service has also been detected cutting into the north of the area.

8.2. Archaeological activity has mostly been identified in the north of the survey area, concentrated around two probable trackway features. Rectilinear and D-shaped enclosures have been detected showing degrees of overlap with each other and the trackways. The overlapping nature of these anomalies indicates possible multiphase activity. Pit-like anomalies have also been detected; these appear to be in concentrated clusters mostly within one of the enclosures and the north of the trackway. An isolated enclosure detected near the centre of the survey area shares a similar form to those in the north; however, it has no associated trackways or other nearby enclosures. A potential ring ditch anomaly has also been identified; however due to its location a confident archaeological interpretation cannot be ascribed, and a possible archaeological classification has been given. The range of different archaeological features identified across the survey area is in keeping with the late prehistoric to medieval archaeological records which surround the site.

8.3. Historic agricultural activity has been detected in the form of ridge and furrow cultivation which lies in close proximity to the archaeological anomalies, in some instances respecting the archaeological boundaries. Former field boundaries, field drains as well as modern agricultural activity, in the form of ploughing trends and tractor tracks have also been detected.

8.4. Other historic activity detected within the survey area includes remnants of mapped World War II anti-tank trenches, as well as anomalies possibly related to unmapped but associated features. A former railway line also crosses the south of the survey area which has produced significant magnetic disturbance.

9. Archiving

9.1. MS maintains an in-house digital archive, which is based on Schmidt and Ernenwein (2013). This stores the collected measurements, minimally processed data, georeferenced and un-georeferenced images, XY traces and a copy of the final report.

9.2. MS contributes reports to the ADS Grey Literature Library upon permission from the client, subject to the any dictated time embargoes.

10. Copyright

10.1. Copyright and the intellectual property pertaining to all reports, figures, and datasets produced by Magnitude Services Ltd. is retained by MS. The client is given full licence to use such material for their own purposes. Permission must be sought by any third party wishing to use or reproduce any IP owned by MS.

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12. Project Metadata

MS Job Code	MSTL609
Project Name	Cambridge South East Transport Phase 2
Client	Cambridge Archaeological Unit
Grid Reference	TL 4596 5438 to TL 5071 4952
Survey Techniques	Magnetometry
Survey Size (ha)	69.3 ha (Magnetometry)
Survey Dates	20 January – 7 February
Project Manager	Finnegan Pope-Carter BSc (Hons) MSc FGS
Project Officer	Frederick Salmon BSc FGS
HER Event No	ECB6216
OASIS No	N/A
S42 Licence No	N/A
Report Version	1.0

13. Document History

Version	Comments	Author	Checked By	Date
0.1	Initial draft for Project Officer to Review	MC, BF	FS	12 January 2020
0.2	Draft for Project Manager Review	PT	CH	14 January 2020
0.3	Corrections from Project Manager Review	LS, MF, JD	KA	19 February 2020
1.0	Final Submission to client	AL	FS	12 January 2020

MSTL609 - Cambridge South East Transport Phase 2
Figure 1 - Site Location
1:35,000 @ A4
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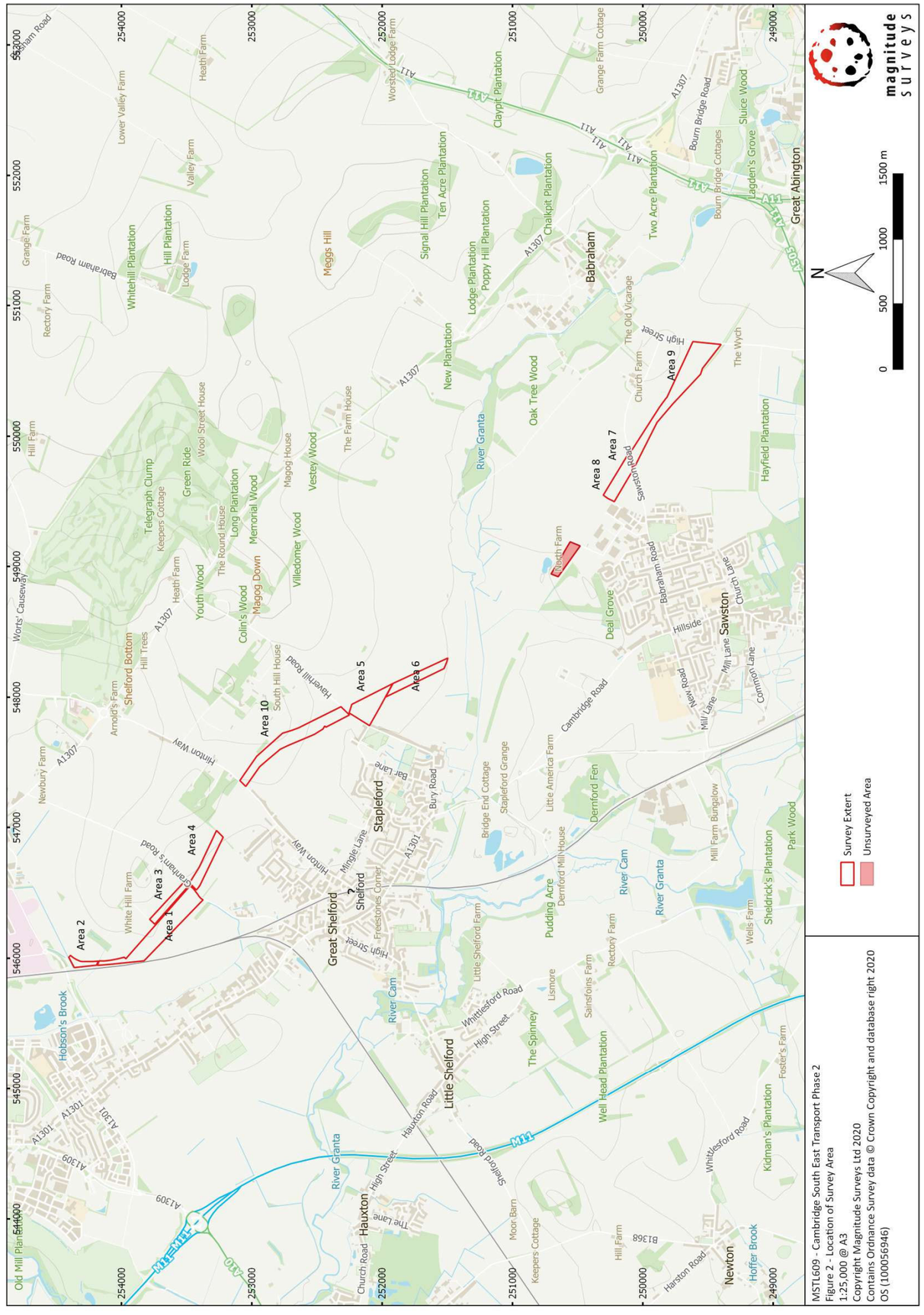
OS (100056946)

Site Boundary Unsurveyed Area

N
0 0.5 1 km

magnitude surveys



MSTL609 - Cambridge South East Transport Phase 2
Figure 2 - Location of Survey Area
1:25,000 @ A3
Copyright Magnitude Surveys Ltd 2020
Contains Ordnance Survey data © Crown Copyright and database right 2020
OS (100056946)

546700
254100
Dame Mary Archer Way
White Hill Farm
Granham's Road
Area 2
Area 3
Area 4
Area 1
253000
545600
Coppice Avenue
Macaulay Avenue
Macaulay Avenue
546700
Lapwing Avenue
Cabbage Moor
254100

MSTL609 - Cambridge South East Transport Phase 2
Figure 3 - Magnetic Gradient (North)
1:5,000 @ A3

-1 nT 2

1
2
3

0 100 200 300 m

magnitude surveys

546700
254100
Dame Mary Archer Way
White Hill Farm
Granham's Road
Area 2
Area 3
Area 4
Area 1
253000
545600
Coppice Avenue
Macaulay Avenue
Macaulay Avenue
546700
Lapwing Avenue
Cabbage Moor
254100

MSTL609 - Cambridge South East Transport Phase 2
Figure 4 - Magnetic Interpretation (North)
1:5,000 @ A3

- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Agricultural (Weak)
- Undetermined (Weak)
- Natural (Weak)
- Magnetic Disturbance
- Open
- Archaeology Probable (Trend)
- Agricultural (Trend)
- Service
- Ridge and Furrow (Trend)
- Drainage Feature
- Ferrous (Spike)

1
2
3

0 100 200 300 m

magnitude surveys

MSTL609 - Cambridge South East Transport Phase 2
Figure 5 - Magnetic Interpretation Over Historic Maps and Satallite Imagery (North)
1:5,000 @ A3

- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Agricultural (Weak)
- Undetermined (Weak)
- Natural (Weak)
- Magnetic Disturbance
- Open
- Archaeology Probable (Trend)
- Agricultural (Trend)
- Service
- Ridge and Furrow (Trend)
- Drainage Feature
- Ferrous (Spike)

0 100 200 300 m

magnitude surveys

MSTL609 - Cambridge South East Transport Phase 2
Figure 6 - Magnetic Gradient (Centre)
1:5,000 @ A3

-1 nT 2

0 100 200 300 m

magnitude surveys

547800
253000
548900
251900
546700

Area 10
Area 5
Area 6
South Hill House
Haverhill Road
Hinton Way
Chalk Hill
Play Space
Playing Field
Play Space
Gog Magog Way
Finch's Close
Bar Close
Bar Lane
Dukes Meadow
Cemetery
Allotments

MSTL609 - Cambridge South East Transport Phase 2
Figure 7 - Magnetic Interpretation (Centre)
1:5,000 @ A3

Archaeology Probable (Strong)
Archaeology Probable (Weak)
Archaeology Possible (Strong)
Archaeology Possible (Weak)
Undetermined (Weak)
Natural (Strong)
Natural (Weak)
Natural (Spread)
Magnetic Disturbance
Ferrous/Debris (Spread)
World War II Defences
Agricultural (Trend)
Drainage Feature
Ferrous (Spike)

1
2
3

N
0 100 200 300 m

magnitude surveys

547800
253000
548900
251900
546700

Area 10
Area 5
Area 6
B.M. 113·4
B.M. 87·9
B.M. 75·7
Windmill
Stapleford Hall
Greenhedge Farm
CEMETERY
St. Andrew's Church
Sunday School
Vicarage
Stapleford

MSTL609 - Cambridge South East Transport Phase 2
Figure 8 - Magnetic Interpretation Over Historic Maps and Satallite Imagery (Centre)
1:5,000 @ A3

Archaeology Probable (Strong)
Archaeology Probable (Weak)
Archaeology Possible (Strong)
Archaeology Possible (Weak)
Undetermined (Weak)
Natural (Strong)
Natural (Weak)
Natural (Spread)
Magnetic Disturbance
Ferrous/Debris (Spread)
World War II Defences
Agricultural (Trend)
Drainage Feature
Ferrous (Spike)

1
2
3

N
0 100 200 300 m

magnitude surveys

550000

551100

Area 8

Area 7

Area 9

Babraham Pocket Park

Other Sports Facility

The Old Vicarage

Rowley Lane

Sawston Road

Church Farm

Middle Way

East Way

Grove Road

Babraham Road

Playing Field

Lynton Way

Stanley Webb Close

High Street

249700

The Icknield Primary School

The Green Road

Plantation Road

249700

MSTL609 - Cambridge South East Transport Phase 2
Figure 9 - Magnetic Gradient (South)
1:5,000 @ A3

-1 nT 2

1

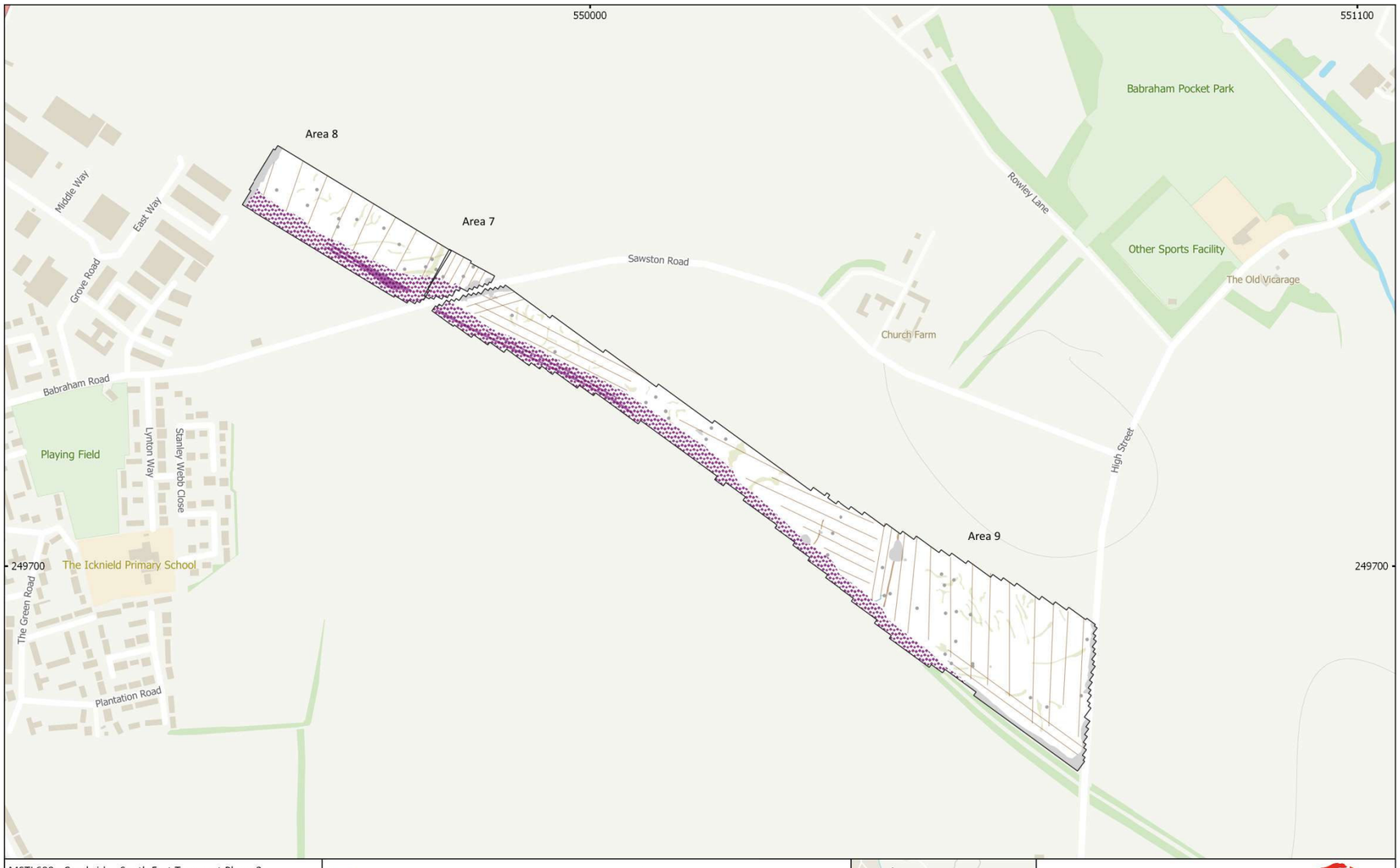
2

3

N

0 100 200 300 m

magnitude surveys



MSTL609 - Cambridge South East Transport Phase 2
Figure 10 - Magnetic Interpretation (South)
1:5,000 @ A3

Agricultural (Weak)
Undetermined (Weak)
Natural (Weak)
Magnetic Disturbance
Former Railway
World War II Defences
Agricultural (Trend)
Ferrous (Spike)

1

2

3

N

0 100 200 300 m

magnitude surveys

MSTL609 - Cambridge South East Transport Phase 2
Figure 11 - Magnetic Interpretation Over Historic Maps and Satallite Imagery (South)
1:5,000 @ A3

Agricultural (Weak)
Undetermined (Weak)
Natural (Weak)
Magnetic Disturbance
Former Railway
World War II Defences
Agricultural (Trend)
Ferrous (Spike)

0 100 200 300 m

MSTL609 - Cambridge South East Transport Phase 2
Figure 12 - Magnetic Gradient (North (North))
1:1,500 @ A3

-1 nT 2

0 50 100 150 m

magnitude surveys

254250

545850

545850

Area 2

MSTL609 - Cambridge South East Transport Phase 2
Figure 13 - Magnetic Interpretation (North (North))
1:1,500 @ A3

Archaeology Probable (Weak)
Undetermined (Weak)
Magnetic Disturbance
Agricultural (Trend)
Service
Drainage Feature
Ferrous (Spike)

N

0 50 100 150 m

magnitude surveys

MSTL609 - Cambridge South East Transport Phase 2
Figure 14 - XY Trace Plot (North (North))
30nT/cm at 1:1,500 @ A3

N

0 50 100 150 m

magnitude surveys

546300

253800

Area 3

253800

Area 1

MSTL609 - Cambridge South East Transport Phase 2
Figure 15 - Magnetic Gradient (North (Centre))
1:1,500 @ A3

-1 nT 2

0 50 100 150 m

magnitude surveys

546300

253800

Area 3

3b
3e
3a
3f
3e
3c
3d

1e
1d
1f
1g
1h
1b
1l
1a
1c
1b
1j
1l

253800

Area 1

MSTL609 - Cambridge South East Transport Phase 2
Figure 16 - Magnetic Interpretation (North (Centre))
1:1,500 @ A3

- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Natural (Weak)
- Magnetic Disturbance
- Burnt/ Fired Material
- Archaeology Probable (Trend)
- Agricultural (Trend)
- Service
- Ridge and Furrow (Trend)
- Ferrous (Spike)

0 50 100 150 m

magnitude surveys

546300

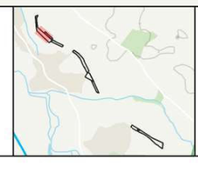
253800

Area 3

253800

Area 1

MSTL609 - Cambridge South East Transport Phase 2
Figure 17 - XY Trace Plot (North (Centre))
30nT/cm at 1:1,500 @ A3



0 50 100 150 m

magnitude surveys

546750

253350

Area 3

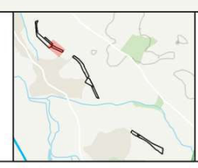
Area 4

Granham's Road

Area 1

MSTL609 - Cambridge South East Transport Phase 2
Figure 18 - Magnetic Gradient (North (South))
1:1,500 @ A3

-1 nT 2



0 50 100 150 m

magnitude surveys

546750

253350

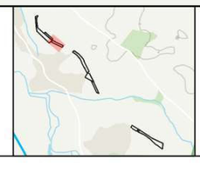
Area 4

Granham's Road

1j

MSTL609 - Cambridge South East Transport Phase 2
Figure 19 - Magnetic Interpretation (North (South))
1:1,500 @ A3

- Archaeology Probable (Weak)
- Agricultural (Weak)
- Undetermined (Weak)
- Natural (Weak)
- Magnetic Disturbance
- Agricultural (Trend)
- Service
- Ridge and Furrow (Trend)
- Drainage Feature
- Ferrous (Spike)



N

0 50 100 150 m

magnitude surveys

546750

253350

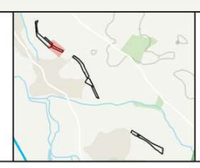
Area 3

Area 4

Granham's Road

Area 1

MSTL609 - Cambridge South East Transport Phase 2
Figure 20 - XY Trace Plot (North (South))
30nT/cm at 1:1,500 @ A3



N

0 50 100 150 m

magnitude surveys

252900

Hinton Way

Area 10

547650

547650

MSTL609 - Cambridge South East Transport Phase 2
Figure 21 - Magnetic Gradient (Centre (North))
1:1,500 @ A3

-1 nT 2

N

0 50 100 150 m

magnitude surveys

252900

Hinton Way

10a

10c

10b

10d

547650

547650

MSTL609 - Cambridge South East Transport Phase 2
Figure 22 - Magnetic Interpretation (Centre (North))
1:1,500 @ A3

- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Natural (Weak)
- Magnetic Disturbance
- Ferrous/Debris (Spread)
- World War II Defences
- Agricultural (Trend)
- Drainage Feature
- Ferrous (Spike)

N

0 50 100 150 m

magnitude surveys

252900

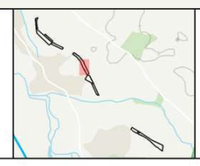
Hinton Way

Area 10

547650

547650

MSTL609 - Cambridge South East Transport Phase 2
Figure 23 - XY Trace Plot (Centre (North))
30nT/cm at 1:1,500 @ A3



N

0 50 100 150 m

magnitude surveys

252450

547650

547650

Area 10

Haverhill Road

MSTL609 - Cambridge South East Transport Phase 2
Figure 24 - Magnetic Gradient (Centre (Centre))
1:1,500 @ A3

-1 nT 2

N

0 50 100 150 m

magnitude surveys

252450

547650

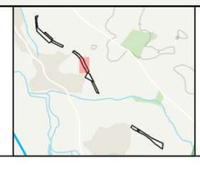
547650

10e

Haverhill Road

MSTL609 - Cambridge South East Transport Phase 2
Figure 25 - Magnetic Interpretation (Centre (Centre))
1:1,500 @ A3

- Undetermined (Weak)
- Natural (Strong)
- Natural (Weak)
- Natural (Spread)
- Magnetic Disturbance
- Ferrous/Debris (Spread)
- World War II Defences
- Agricultural (Trend)
- Drainage Feature
- Ferrous (Spike)



N

0 50 100 150 m

magnitude surveys

252450

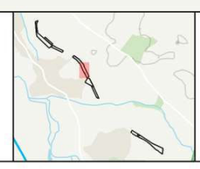
547650

547650

Area 10

Haverhill Road

MSTL609 - Cambridge South East Transport Phase 2
Figure 26 - XY Trace Plot (Centre (Centre))
30nT/cm at 1:1,500 @ A3



N

0 50 100 150 m

magnitude surveys

252000

Area 10

Haverhill Road

Area 5

Area 6

548100

548100

MSTL609 - Cambridge South East Transport Phase 2
Figure 27 - Magnetic Gradient (Centre (Centre))
1:1,500 @ A3

-1 nT 2

N

0 50 100 150 m

magnitude surveys

252000

5a

Haverhill Road

5b

Area 5

6a

548100

548100

MSTL609 - Cambridge South East Transport Phase 2
Figure 28 - Magnetic Interpretation (Centre (Centre))
1:1,500 @ A3

- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Natural (Strong)
- Natural (Weak)
- Natural (Spread)
- Magnetic Disturbance
- World War II Defences
- Agricultural (Trend)
- Drainage Feature
- Ferrous (Spike)

N

0 50 100 150 m

magnitude surveys

252000

Area 10

Haverhill Road

Area 5

Area 6

548100

548100

MSTL609 - Cambridge South East Transport Phase 2
Figure 29 - XY Trace Plot (Centre (Centre))
30nT/cm at 1:1,500 @ A3

N

0 50 100 150 m

magnitude surveys

251550

252000

Area 5

Area 6

548100

548100

MSTL609 - Cambridge South East Transport Phase 2
Figure 30 - Magnetic Gradient (Centre (South))
1:1,500 @ A3

-1 nT 2

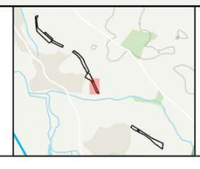
N

0 50 100 150 m

magnitude surveys

MSTL609 - Cambridge South East Transport Phase 2
Figure 31 - Magnetic Interpretation (Centre (South))
1:1,500 @ A3

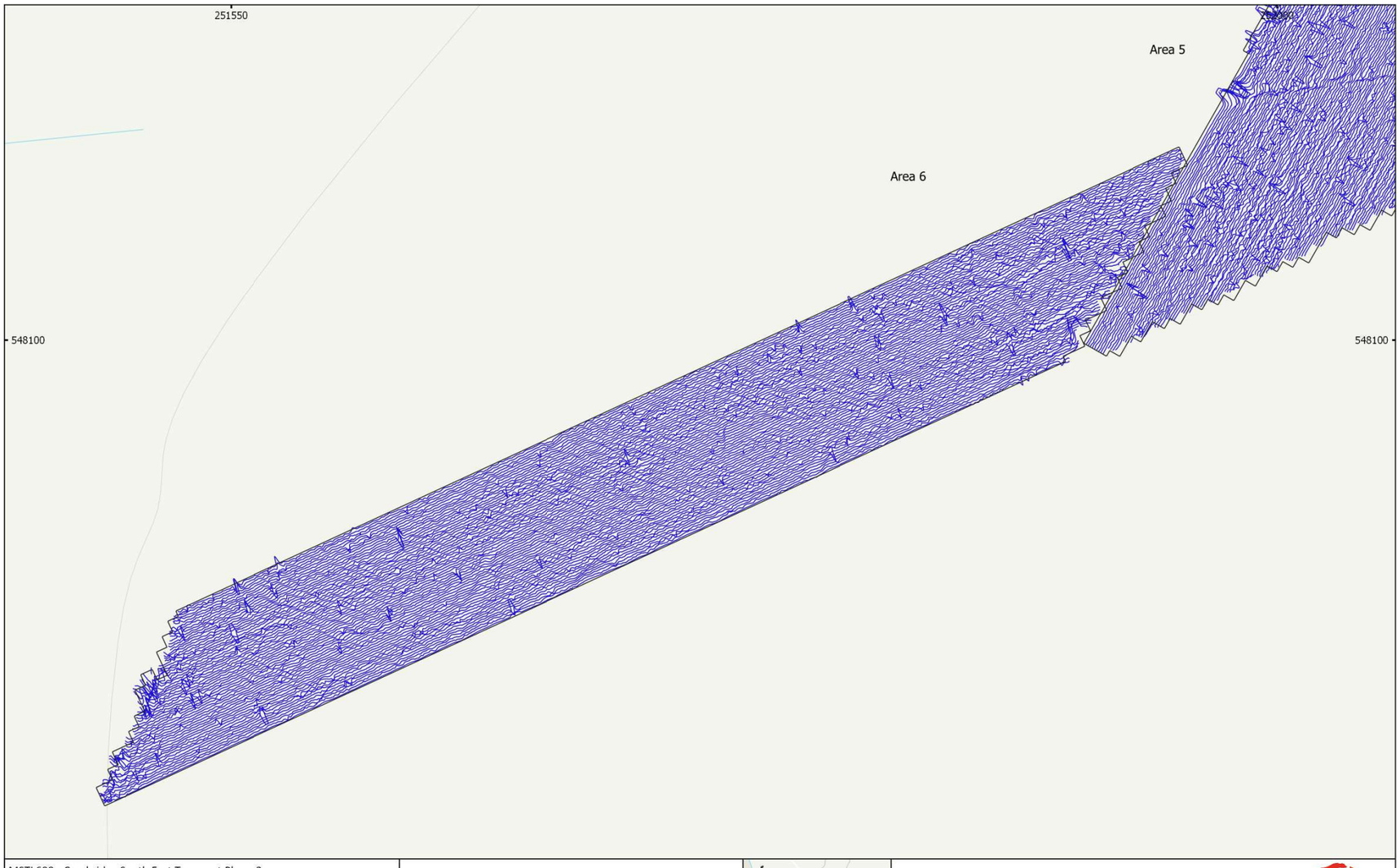
- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Possible (Strong)
- Natural (Strong)
- Natural (Weak)
- Natural (Spread)
- Magnetic Disturbance
- World War II Defences
- Agricultural (Trend)
- Drainage Feature
- Ferrous (Spike)



N

0 50 100 150 m

magnitude surveys



MSTL609 - Cambridge South East Transport Phase 2
Figure 32 - XY Trace Plot (Centre (South))
30nT/cm at 1:1,500 @ A3

N

0 50 100 150 m

magnitude surveys

549900 250200

Area 7

Area 8

Area 9

Sawston Road

549450

250200

549900

MSTL609 - Cambridge South East Transport Phase 2
Figure 33 - Magnetic Gradient (South (North))
1:1,500 @ A3

-1 nT 2

0 50 100 150 m

magnitude surveys

MSTL609 - Cambridge South East Transport Phase 2
Figure 34 - Magnetic Interpretation (South (North))
1:1,500 @ A3

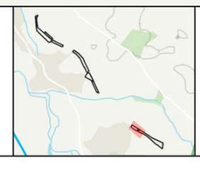
Natural (Weak)
Magnetic Disturbance
Former Railway
World War II Defences
Agricultural (Trend)
Ferrous (Spike)

0 50 100 150 m

magnitude surveys

549900
250200
Area 7
Area 8
Area 9
Sawston Road
549450
549900
250200

MSTL609 - Cambridge South East Transport Phase 2
Figure 35 - XY Trace Plot (South (North))
30nT/cm at 1:1,500 @ A3



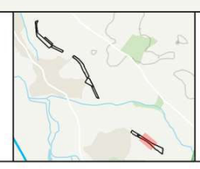
0 50 100 150 m

magnitude surveys

250200
250200
Sawston Road
550350
249750
249750
550350
Area 9

MSTL609 - Cambridge South East Transport Phase 2
Figure 36 - Magnetic Gradient (South (Centre))
1:1,500 @ A3

-1 nT 2



0 50 100 150 m

magnitude surveys

250200

550350

Sawston Road

249750

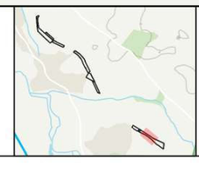
9a

549900

550350

MSTL609 - Cambridge South East Transport Phase 2
Figure 37 - Magnetic Interpretation (South (Centre))
1:1,500 @ A3

- Agricultural (Weak)
- Natural (Weak)
- Magnetic Disturbance
- Former Railway
- World War II Defences
- Agricultural (Trend)
- Ferrous (Spike)



N

0 50 100 150 m

magnitude surveys

250200

550350

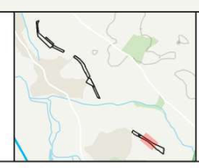
Sawston Road

249750

Area 9

550350

MSTL609 - Cambridge South East Transport Phase 2
Figure 38 - XY Trace Plot (South (Centre))
30nT/cm at 1:1,500 @ A3



N

0 50 100 150 m

magnitude surveys

Sawston Road

249750

550800

High Street

Area 9

550350

550800

249750

MSTL609 - Cambridge South East Transport Phase 2
Figure 39 - Magnetic Gradient (South (South))
1:1,500 @ A3

-1 nT 2

0 50 100 150 m

magnitude surveys

Sawston Road

249750

550800

High Street

Area 9

550350

550800

9b

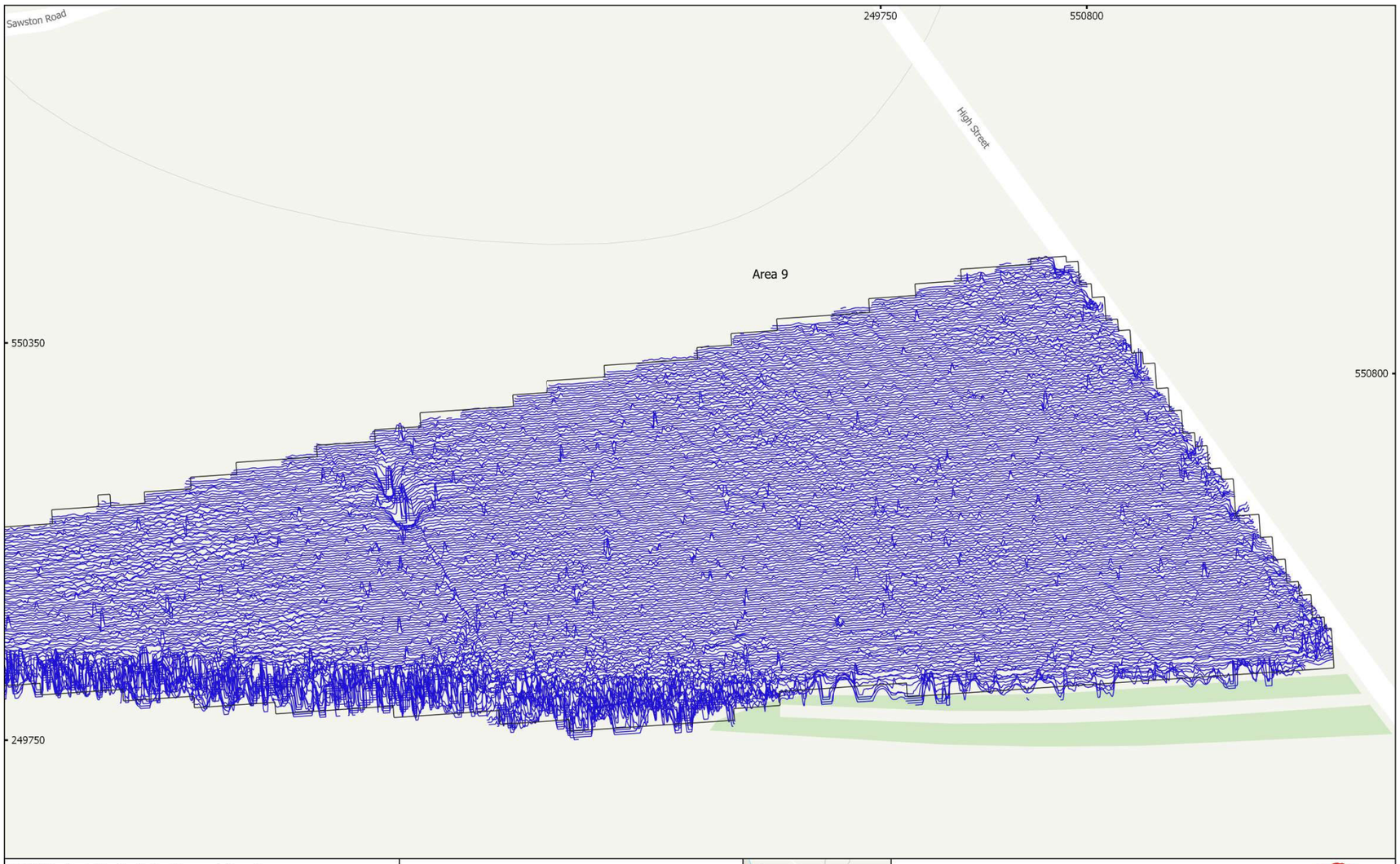
249750

MSTL609 - Cambridge South East Transport Phase 2
Figure 40 - Magnetic Interpretation (South (South))
1:1,500 @ A3

- Agricultural (Weak)
- Undetermined (Weak)
- Natural (Weak)
- Magnetic Disturbance
- Former Railway
- Agricultural (Trend)
- Ferrous (Spike)

0 50 100 150 m

magnitude surveys



MSTL609 - Cambridge South East Transport Phase 2
Figure 41 - XY Trace Plot (South (South))
30nT/cm at 1:1,500 @ A3