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magnitude surveys

Geophysical Survey Report MSSK91

of

Land South of Tatenhill Lane,

Branston, Staffordshire

RECEIVED
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For

Oxford Archaeology

On Behalf Of

Lioncourt Homes

Magnitude Surveys Ref: MSSK91

February 2017

magnitude surveys

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Abstract

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a c. 2.67ha area of land south of Tatenhill Lane, Branston, Staffordshire. A cart-mounted fluxgate gradiometer survey was successfully completed and no anomalies of probable or possible archaeological origin were identified. The geophysical results primarily reflect ferrous anomalies caused by modern activity, as well natural soil and geological variations. Several very weak, linear anomalies have been classified as "Undetermined" as a specific origin for their response cannot be confidently identified through the geophysical results alone.

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1. Introduction

1.1. Magnitude Surveys Ltd (MS) was commissioned by Oxford Archaeology (OA) on behalf of Lioncourt Homes to undertake a geophysical survey on a c. 2.67ha area of land south of Tatenhill Lane, Branston, Staffordshire (SK 2172 2115).

1.2. The geophysical survey comprised hand pulled, cart-mounted 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 Charted Institute of Field Archaeologists (CIfA, 2014) and the European Archaeological Council (Schmidt et al., 2015).

1.4. The survey commenced on 3 February and took 1 day to complete. The work was conducted in-line with the archaeological evaluation brief by Staffordshire County Council (2017).

2. Quality Assurance

2.1. Project management, survey work, data processing and report production have been carried out by qualified and professional geophysicists to standards exceeding the current best practice (CIfA, 2014; David et al., 2008, Schmidt et al., 2015).

2.2. Magnitude Surveys is a corporate member of ISAP (International Society of Archaeological Prospection).

2.3. Director Graeme Attwood is a Member of the Chartered Institute for Archaeologists (CIfA), the chartered UK body for archaeologists, as well as a Secretary of GeoSIG, the CIfA Geophysics Special Interest Group. 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. Director Chrys Harris is a doctoral candidate in archaeological geophysics at the University of Bradford.

2.4. All MS managers have postgraduate qualifications in archaeological geophysics. All MS field staff have relevant archaeology or geophysics degrees and supervisors have at least three years' field experience.

3. Objectives

3.1. The geophysical survey aimed to assess the subsurface archaeological potential of the survey area.

4. Geographic Background

4.1. The site is located at the western end of Branston, Staffordshire, c. 4km south-west from the centre Burton-upon-Trent (Figure 1). Survey was undertaken over a single field under pasture (Figure 2). The site is bounded to the north by housing, off Tatenhill Lane, The Trent and Mersey Canal to the west, Branston Water Park to the south, and a car park to the east.

4.2. The underlying geology comprises mudstone sedimentary bedrock of the Mercia Mudstone Group. Superficial deposits consist of sand and gravel of Holme Pierrepont Member (British Geological Survey, 2017).

4.3. The soils are described as naturally wet, loamy with high groundwater (Soilscapes, 2017).

4.4. Survey considerations:

Survey Area	No. Survey Blocks	Surveyed Y/N	Ground Conditions	Further notes:
1	1	Y	Flat, pasture.	Wire fencing and a gate were located at along the site's northern end. A group of shrubbery near the eastern end of site presented a minor obstacle to manoeuvre around.

5. Archaeological Background

5.1. The following section summaries the significant heritage assets recorded within a 1km search from the centre of the site on Heritage Gateway (2017), as well as background information in Staffordshire County Council's archaeological evaluation brief (2017).

5.2. The site has not been subject of any previous archaeological or geophysical investigations. No heritage assets have been recorded within the site itself.

5.3. Prehistoric and Iron Age/Romano-British activity has been identified in the site's wider landscape. Much of the evidence for this activity derives from artefactual finds (MST16077, MST6117, MST3224) and the identification of cropmarks through aerial photographs. The range of potential features identified in the aerial photographs include ring ditch enclosures (MST1399) 900m north of site, rectangular enclosures of possible Bronze Age to Roman date 600m northwest of site (MST1400), a Neolithic mortuary enclosures 1.1km northeast of site (MST4196).

5.4. A Mesolithic burial (MST895) with a wooden structure, interpreted as a possible a platform, has been recorded 900m south of site. Recent archaeological investigations c. 750m northwest of site have recorded evidence for prehistoric activity spanning from the Mesolithic through Bronze Age. The same investigations also recorded evidence for Iron Age activity and a potential Romano-British farmstead. A nearby metalled surface, interpreted as a possible Roman trackway, is speculated as connecting with the Ryknild Street Roman road (PRN 01144).

5.5. The settlement of Branston is recorded in the Domesday Survey of 1086. Ridge and furrow ploughing (MST1402) has been identified 1km northeast of site. Post-medieval agricultural activity has been identified in the wider landscape as well (MST4196, MST8562, MST18654, MST13812).

5.6. Findspots in the area have recorded activity of Bronze Age (MST16077, MST6117, MST3224), Romano (MST3432, MST15906) and Post Medieval (MST16950) periods.

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	1 m	200 Hz reprojected to 0.125 m

6.1.3. The magnetic data were collected using MS' bespoke hand-pulled cart system.

6.1.3.1. MS' cart system was comprised of Bartington Instruments Grad 13 Digital Three-Axis Gradiometers. Positional referencing was through a Hemisphere S321 GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The Hemisphere S321 GNSS Smart Antenna is accurate to 0.008 m + 1 ppm in the horizontal and 0.015 m + 1 ppm 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 is ongoing.

6.1.3.3. A series of temporary sight markers were established in each survey area to guide the surveyor and ensure full coverage with the cart. Data were collected by traversing the survey area along the longest possible lines, to ensure that the data was efficiently collected and processed.

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. Multiple greyscales images at different plotting ranges have been used for data interpretation. Greyscale images should be viewed alongside the XY trace plots (Figure 7). 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 mapping, satellite imagery and historic mapping.

7. Results

7.1. Qualification

7.1.1. Geophysical techniques 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 (Bing, 2017; Figure 5) and historic mapping (Ordnance Survey, 6" 2nd edition *c.*1882-1913; Figure 6).

7.2.2. The magnetic survey has responded well to the survey area's environment. No anomalies of possible or probable archaeological origin have been identified. Modern activity has been detected, evident by the ferrous-type responses associated with the neighbouring structures and the canal. Natural responses reflecting variation in the soils and geology have been detected across the site. A number of anomalies have been given an "Undetermined" classification, due to their ambiguous form or patterning of response.

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. **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.

7.3.1.1. **Ferrous (Discrete/Spread) –** Discrete ferrous-like, dipolar anomalies are likely to be the result of modern metallic disturbance on or near the ground surface. A ferrous spread refers to a concentrated scattering of these discrete, dipolar anomalies. Broad dipolar ferrous responses from modern metallic features, such as fences, gates, neighbouring buildings and services, may mask any weaker underlying archaeological anomalies should they be present.

7.3.2. Magnetic Results - Specific Anomalies

7.3.2.1. **Natural** – A number of weak, amorphous responses have been detected towards the centre of the site. The magnitude and form of these responses is characteristic of minor variations in the soil's magnetic properties. Strong, positive magnetic point responses are likely to represent superficial sand and gravel deposits.

7.3.2.2. **Ferrous (Spread)** – A number of large and small areas of discrete bipolar responses have been detected across the northern and eastern edges of the site. Areas of this type of response are likely to be associated with a concentration of modern metallic debris on or near the ground surface. They often occur near areas of modern activity, such as housing and development areas.

7.3.2.3. **Undetermined** – An "L" shaped weak, negative linear anomaly [**1A**] has been detected near an area of "Ferrous (Spread") at the site's northern boundary. The origin for this response is likely anthropogenic, given the sharp right angle of the anomaly's "L" shape. Its occurrence with an area of "Ferrous (Spread") suggests a potential modern origin; although this occurrence could be merely coincidental. Therefore, an archaeological origin cannot be entirely ruled out.

Several weak, linear anomalies [**1B**] have been detected near the southeastern half of site, which occur parallel with the southeastern field boundary. These anomalies do not correlate with any features denoted on the historic mapping or identifiable in recent satellite imagery (Google Earth Pro, 2017). The anomalous responses of [**1B**] are not unique in magnitude or form to confidently ascribe a specific origin.

8. Conclusions

8.1. A cart-based fluxgate gradiometer survey has been successfully undertaken across this site. No anomalies of possible or probable archaeological origin have been identified. The detection of activity both natural and modern in origin, represented by responses both strong and weak in magnitude, demonstrate the magnetic method has been effective on this site. The fluxgate gradiometer results primarily reflect natural soil variations and modern activity along the site's perimeter.

8.2. Modern activity on site has primarily been detected in the form of ferrous responses; most of which are concentrated along the northern and western ends of site. The origin of these responses can be attributed to the close proximity of the Trent and Mersey Canal and housing.

8.3. Amorphous anomalies of natural variation are evident across the centre of the site. These are likely to be a result of the variations in the soil's magnetic properties.

8.4. Anomalies have been classified as "Undetermined" where the specific origin for the response cannot be identified through the geophysical results and available supplementary evidence. These anomalies may be the result of modern, agricultural, archaeological or natural processes.

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 all reports to the ADS Grey Literature Library subject to any time embargo dictated by the client.

9.3. Whenever possible, MS has a policy of making data available to view in easy to use forms on its website. This can benefit the client by making all of their reports available in a single repository, while also being a useful resource for research. Should a client wish to impose a time embargo on the availability of data, this can be achieved in discussion with MS.

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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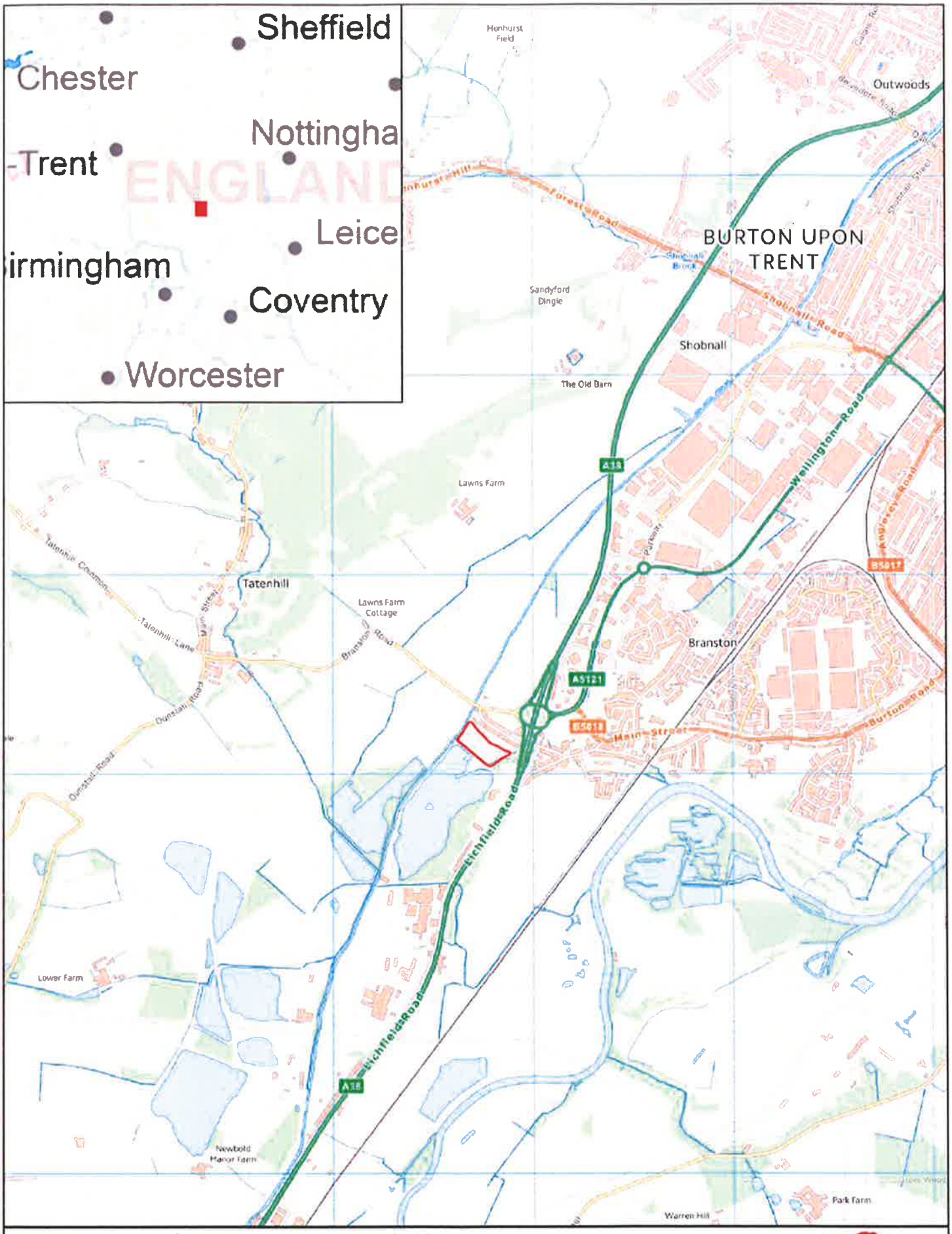

MSSK91 - Land south of Tatenhill Lane, Branston, Staffordshire
Figure 1 - Site Location
1 : 25,000 @ A4

Site Boundary

N

0 0.5 1 km

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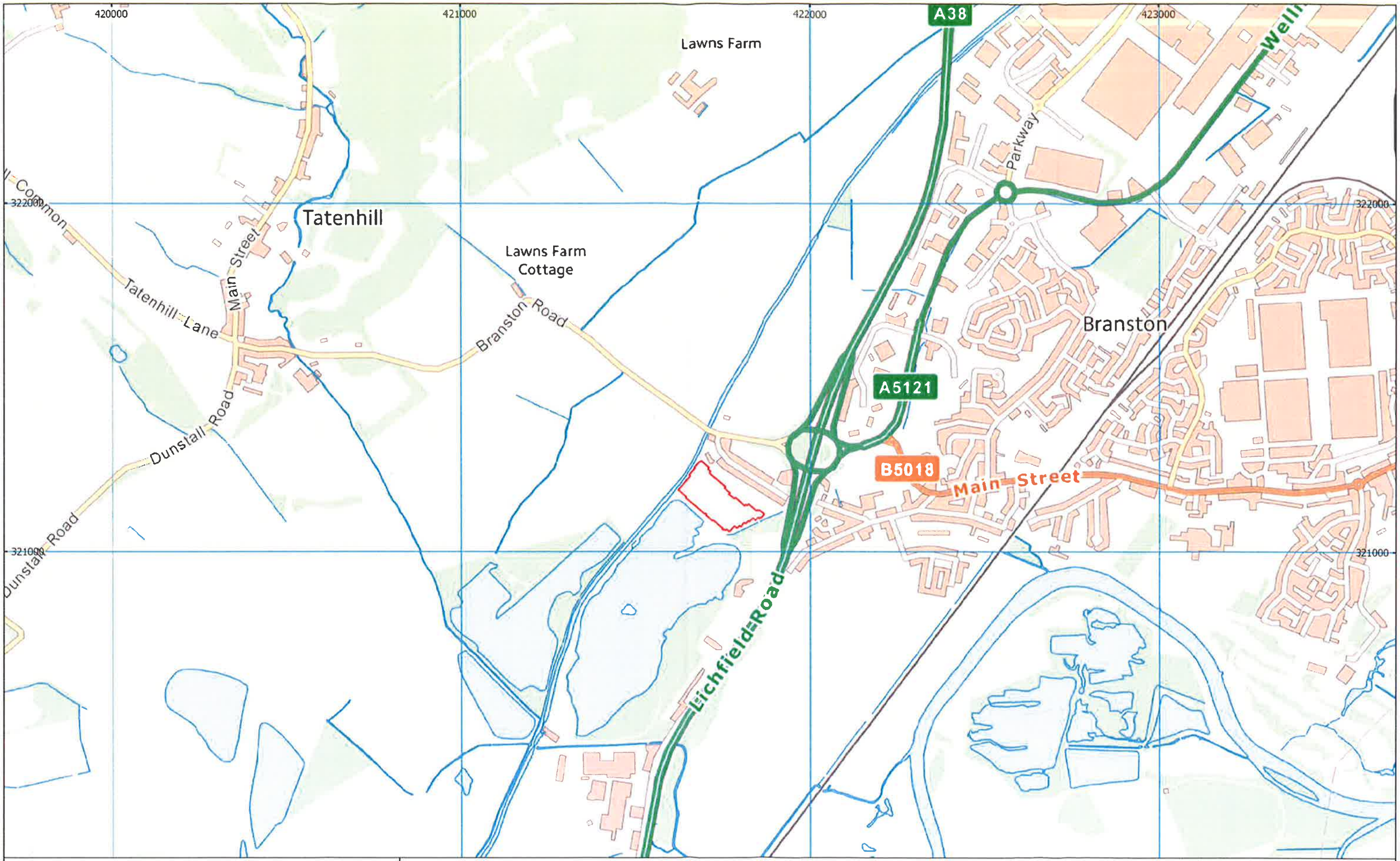

MSSK91 - Land South of Tatenhill Lane, Branston, Staffordshire
Figure 2 - Location of Survey Area
1 : 10,000 @ A3

Survey Area

N

0 250 500 750 m

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421600
421700
421800
421900
321200
321100

MSSK91 - Land South of Tatenhill Lane, Branston, Staffordshire
Figure 3 - Magnetic Greyscale
1 : 1000 @ A3

-1 nT 2

N

0 25 50 75 m

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421600
421700
421800
421900
321200
321100
1A
1B
1B

MSSK91 - Land South of Tatenhill Lane, Branston, Staffordshire
Figure 4 - Magnetic Interpretation
1 : 1000 @ A3

Ferrous (Dipolar)
Ferrous (Spread)
Natural (Spread)
Natural (Strong)
Natural (Weak)
Undetermined (Strong)
Undetermined (Weak)

N

0 25 50 75 m

magnitude surveys

MSSK91 - Land South of Tatenhill Lane, Branston, Staffordshire
Figure 5 - Magnetic Interpretation - Satellite
1 : 1000 @ A3

- Ferrous (Dipolar)
- Ferrous (Spread)
- Natural (Spread)
- Natural (Strong)
- Natural (Weak)
- Undetermined (Strong)
- Undetermined (Weak)

N

0 25 50 75 m

magnitude surveys

421500
422000
321500
321500
321000
321000
F.B.
F.P.
Branston Bridge
M.P.
1A
1B
1B
F.P.
Towing Path
Anglesey
Cottages
Poplars Farm
Burton upon Trent 2
Lichfield 10
M.S. Chapel
B.M. 156·0
Gate Inn
Sunday
School
152
Branston

MSSK91 - Land South of Tatenhill Lane, Branston, Staffordshire
Figure 6 - Magnetic Interpretation - Historic
1 : 3000 @ A3

Historic mapping Ordnance Survey, 6" 2nd edition c. 1882-1913 © National Library of Scotland

Ferrous (Dipolar)
Ferrous (Spread)
Natural (Spread)
Natural (Strong)
Natural (Weak)
Undetermined (Strong)
Undetermined (Weak)

N
0 50 100 150 m

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