



of

Land West of Weston Road, Weston-on-Trent

For

**Pegasus Group** 

On Behalf Of Ilke Homes

Magnitude Surveys Ref: MSSK701

OASIS: magnitud1-400354

July 2020



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#### **Abstract**

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a c. 1.17ha area of land west of Weston Road, Weston-on-Trent, South Derbyshire. A fluxgate gradiometer survey was successfully completed across the survey area. The geophysical survey has primarily detected agricultural activity in the form of two former field boundaries, ploughing and drainage features. Anomalies of undetermined origins have also been identified within the survey area; the size of the survey area has limited a clear interpretation of these anomalies. These may relate to modern or agricultural activity and there is nothing in the geophysical survey results to suggest that these anomalies represent significant archaeological features. The impact of modern activity can be seen in the form of the magnetic halo caused by the pylon within the survey area and those of the houses that border the area.

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#### 1. Introduction

- 1.1. Magnitude Surveys Ltd (MS) was commissioned by Pegasus Group, on behalf of Ilke Homes to undertake a geophysical survey on a c.1.17ha area of land west of the Weston Road, Weston-on-Trent, South Derbyshire (SK 4054 2840).
- 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 (2020).
- 1.5. The survey commenced on 19/06/2020 and was completed on the same day.

# 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. The directors of MS are involved in the cutting edge of research and the development of guidance/policy. Specifically, Dr. Chrys Harris has a PhD in archaeological geophysics from the University of Bradford, is a Member of CIfA and is the Vice-Chair of the International Society for Archaeological Prospection (ISAP); Finnegan Pope-Carter has an MSc in archaeological geophysics and is a Fellow of the London Geological Society, as well as a member of GeoSIG (CIfA Geophysics Special Interest Group); Dr. Kayt Armstrong has a PhD in archaeological geophysics from Bournemouth University, is a Member of CIfA, the Editor of ISAP News, and is the UK Management Committee representative for the COST Action SAGA; Dr. Paul Johnson has a PhD in archaeology from the University of Southampton, has been a member of the ISAP Management Committee since 2015, and is currently the nominated representative for the EAA Archaeological Prospection Community to the board of the European Archaeological Association.
- 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 was to assess the subsurface archaeological potential of the survey area.

# 4. Geographic Background

4.1. The survey area was located c.389m north from Weston-on-Trent (Figure 1). Survey was undertaken across one field under arable conditions. The survey area was bounded by a road and houses to the north, Weston Road to the east, houses to the south and there was no physical boundary to the west (Figure 2).

#### 4.2. Survey considerations:

Survey	Ground Conditions	Further Notes
Area		
1	The area consisted of flat arable	The site was bounded to the north by a dirt track,
	land.	to the east by a fence and a hedge, to the south
		by a hedge and to the west by further fields. A
		pylon was located in the northern half of the
		survey area.

- **4.3.** The underlying geology comprises Gunthorpe Member mudstone, with superficial deposits of glaciofluvial sands and gravels in the north, east and southeast of the survey area and Etwall sand and gravels in the southwest and west (British Geological Survey, 2020).
- **4.4.** The soils consist of slightly acidic, loamy, and clayey soils, with impeded drainage (Soilscapes, 2020).

## 5. Archaeological Background

- **5.1.** The following is a summary of a Heritage Desk Based Assessment produced and provided by Pegasus Group (R. Goddard, 2020).
- 5.2. Ridge and furrow cultivation has been recorded across the western half of the survey area and to the north beyond the survey area (HER.MDR1437).
- 5.3. A number of rectilinear, curvilinear and circular enclosures believed to be of Iron Age or Romano-British date were identified by cropmarks (HER.MDR5436) and were located c.430m to the north of survey area and c.320m west. An unspecified amount of Iron Age or Romano-British pottery was found along with possible pot boilers during the excavation of some of the enclosures. A ring ditch was also excavated, due to its form and the presence of a central pit it is believed to be Bronze Age in date. Other cropmarks have been identified c.33m southwest of the survey area (HE.MD7360) and are comprised of ring ditches and linear features thought to form a probable barrow cemetery of Bronze Age date.
- **5.4.** A medieval moat associated with the demolished medieval Weston Hall is located c.25m to the west of the survey area (HER.MDR5432).
- 5.5. A trial trench excavation in association with a demolished public house located c.120m south of the survey area found a rubbish pit dating to the late 11<sup>th</sup> century and contained pottery, butchered animal bone and coal.

5.6. Earthworks thought to be enclosures, field roads and possible buildings have been recorded c.150m south of the survey area and have been identified as a part of a shrunken medieval village (HER.MDR7869).

# 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 multichannel, 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).

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

<u>Zero Median Traverse</u> – 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.

<u>Projection to a Regular Grid</u> – 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.

<u>Interpolation to Square Pixels</u> – 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 (Figure 8). 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 (2020) 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 (Figure 6) and historic mapping (Figure 7).
- 7.2.2. The fluxgate gradiometer survey has responded well to the environment of the survey area. The geophysical survey has primarily detected anomalies interpreted as being related to agricultural activity in the form of former field boundaries, ploughing trends and drainage features. Modern interference can be seen as the effects of the pylon and the houses to the south of the survey area which create magnetic haloes. Minor linear data artefacts have been identified within the dataset which likely relate to the proximity of the overhead service within the survey area. The geology within the area consists of sand and gravels over mudstone, which correlates with the generally quiet background and the scattering of discrete anomalies which likely relate to the variations in texture and composition of the sands and gravels.
- 7.2.3. Two former field boundaries, visible on 2nd edition OS mapping (Figure 7) have been identified along with two drainage features and modern ploughing trends. In addition, some ploughing trends appear to respect the eastern former field boundary, however they could also be modern headland ploughing. Two small anomalies of undetermined origin were identified close to the southern end of the survey area, which may relate to modern or agricultural activity but do not appear to correlate with any identified features.

## 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. **Magnetic Disturbance** The strong anomalies produced by extant metallic structures along the edges of the field 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.

- 7.3.1.3. **Ferrous (Spike)** Discrete ferrous-like, dipolar anomalies are likely to be the result of isolated modern metallic debris on or near the ground surface.
- 7.3.1.4. **Ferrous/Debris (Spread)** A ferrous/debris spread refers to a concentrated deposition of discrete, dipolar ferrous anomalies and other highly magnetic material.
- 7.3.1.5. **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

- 7.3.2.1. Agricultural (Weak) Three linear anomalies have been detected in the east and west of the survey area that align with former field boundaries seen on historic mapping [1a & 1b] (Figure 7). The eastern of these anomalies [1a] consists of two detected sections, the southern exhibiting a weak negative anomaly, and the shorter northern section exhibiting a stronger and dipolar magnetic signal. This suggests a difference in the materials associated with the former boundary, perhaps reflecting a different fill, or different removal method. The gap between the anomalies [1a] may indicate that the field boundary was not continuous between the sections, or it may be related to the halo from the pylon and noise in the data from the overhead service it carries. The western anomaly [1b] displays a weak magnetic enhancement. Only the southern extent of this mapped boundary appears to have been detected, the linear anomaly could extend further northwards, but as with [1a], the magnetic disturbance from the pylon and overhead service may have masked weaker anomalies.
- 7.3.2.2. Agricultural (Trend) Linear trends indicative of modern ploughing have been identified across the survey area following the modern east-west regime (Figure 6). The trends possess a weak positive magnetic enhancement. Further agricultural trends have been identified in the east of the survey area and only on the eastern side of the former field boundary [1a]. The trends also follow the same orientation of [1a]. The location and orientation of the two agricultural trend anomalies suggest that they may relate to ploughing activity which respected the former boundary, although there is a possibility that they relate to headland run ploughing which would also follow this orientation here at the field edge.
- 7.3.2.3. **Magnetic Disturbance** Three strong, dipolar anomalies, indicative of ferrous material, have been detected in line with the two identified former field

boundaries [1a & 1b]. These ferrous anomalies exhibited a very strong magnetic signal, unlike the linear anomalies [1a & 1b] which were much weaker in comparison. These ferrous anomalies likely relate to the composition of or removal of the former boundary.

#### 8. Conclusions

- 8.1. A fluxgate gradiometer survey has successfully been undertaken across the survey area. The geophysical survey has primarily detected anomalies of agricultural origin. The underlying geology has contributed to the generally quiet enhancement of the magnetic data. Modern interference is evident in the form of a magnetic halo caused by the pylon within the survey area and from houses that border the survey area.
- 8.2. No anomalies suggestive of significant archaeological features were identified.
- 8.3. Two former field boundaries have been identified in the eastern and western ends of the survey area. In addition, two drainage features have been detected. Ploughing trends that follow the current regime have been located as well as some ploughing trends that appear to respect the eastern identified former field boundary. Two small anomalies of undetermined origin were identified, which did not appear to relate to any other identified features and there is nothing in the geophysical survey results to suggest that these anomalies represent significant archaeological features.

## 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 ungeoreferenced 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.

#### 11. References

British Geological Survey, 2020. Geology of Britain. Weston-on-Trent, Derbyshire. [http://mapapps.bgs.ac.uk/geologyofbritain/home.html/]. [Accessed 26/06/2020].

Chartered Institute for Archaeologists, 2014. Standards and guidance for archaeological geophysical survey. ClfA.

David, A., Linford, N., Linford, P. and Martin, L., 2008. Geophysical survey in archaeological field evaluation: research and professional services guidelines (2<sup>nd</sup> edition). Historic England.

Goddard, R., 2020. Land to the west of Weston Road, Weston-on-Trent Heritage Desk-Based Assessment.

Google Earth, 2020. Google Earth Pro V 7.1.7.2606.

Magnitude Surveys, 2020. A Written Scheme of Investigation for a Geophysical Survey of Weston-on-Trent, South Derbyshire.

Olsen, N., Toffner-Clausen, L., Sabaka, T.J., Brauer, P., Merayo, J.M.G., Jorgensen, J.L., Leger, J.M., Nielsen, O.V., Primdahl, F., and Risbo, T., 2003. Calibration of the Orsted vector magnetometer. *Earth Planets Space* 55: 11-18.

Schmidt, A. and Ernenwein, E., 2013. Guide to good practice: geophysical data in archaeology. 2nd ed., Oxbow Books, Oxford.

Schmidt, A., Linford, P., Linford, N., David, A., Gaffney, C., Sarris, A. and Fassbinder, J., 2015. Guidelines for the use of geophysics in archaeology: questions to ask and points to consider. EAC Guidelines 2. European Archaeological Council: Belgium.

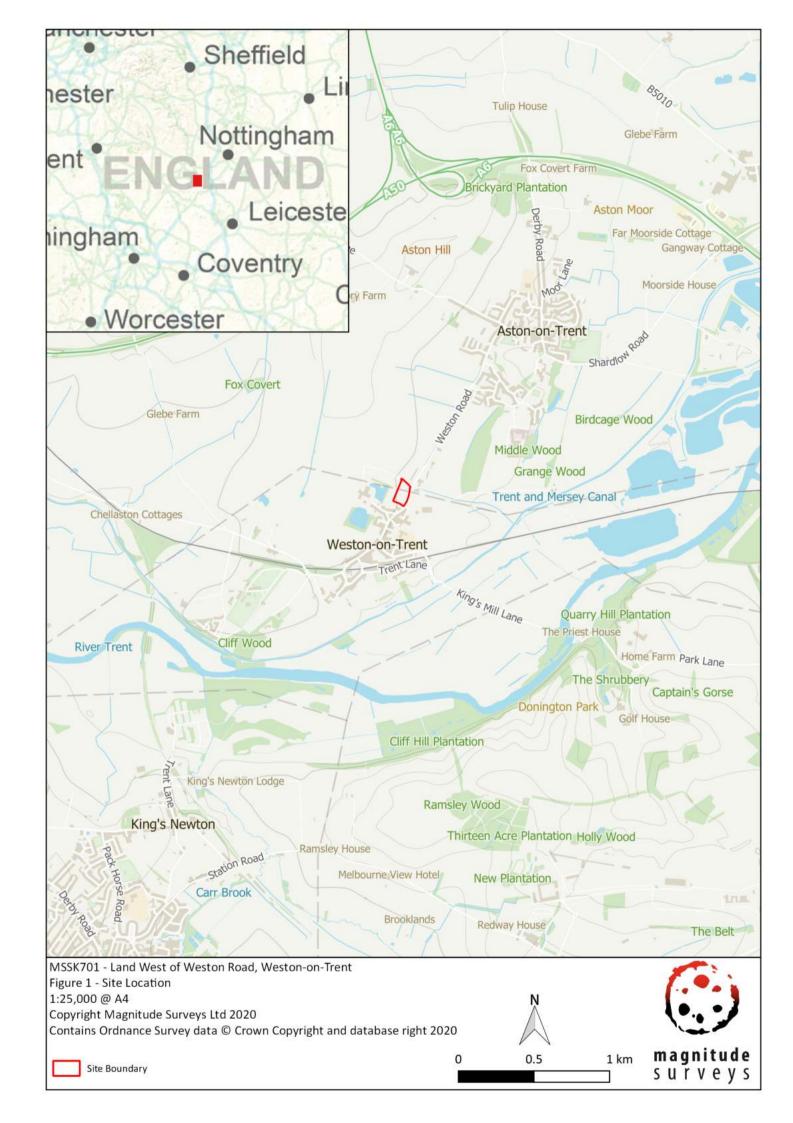
Soilscapes, 2020. Weston-on-Trent, Derbyshire. Cranfield University, National Soil Resources Institute [http://landis.org.uk]. [Accessed 26/06/2020].

# 12. Project Metadata

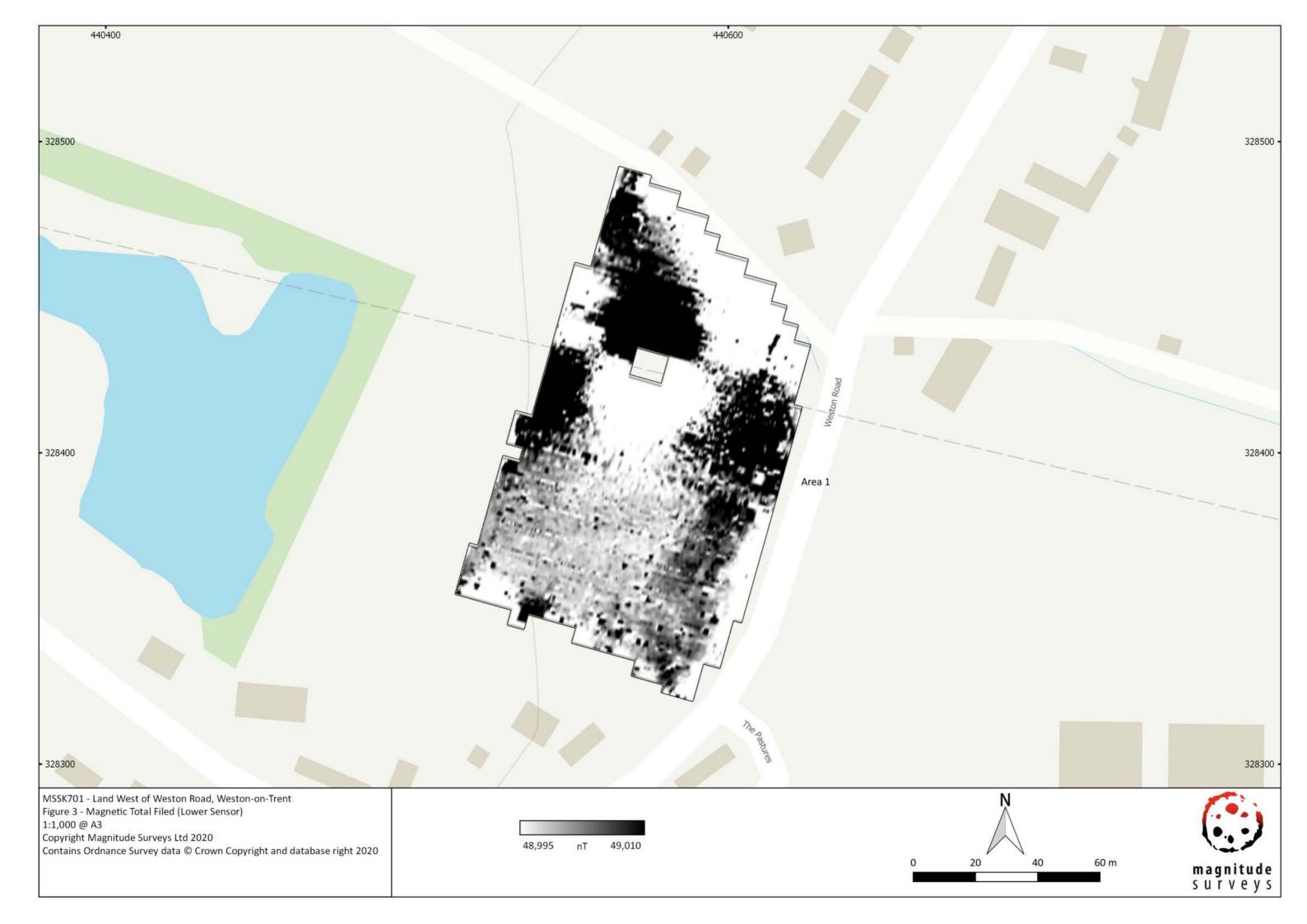
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MS Job Code	MSSK701			
Project Name	Land West of Weston Road, Weston-on-Trent			
Client	Pegues Group			
Grid Reference	SK 4054 2840			
Survey Techniques	Magnetometry			
Survey Size (ha)	1.17ha (Magnetometry)			
Survey Dates	19/06/2020			
Project Lead	Dr. Chrys Harris MCIfA			
Project Officer	Lauren Beck BA			
HER Event No	N/A			
OASIS No	magnitud1-400354			
S42 Licence No	N/A			
Report Version	1.0			

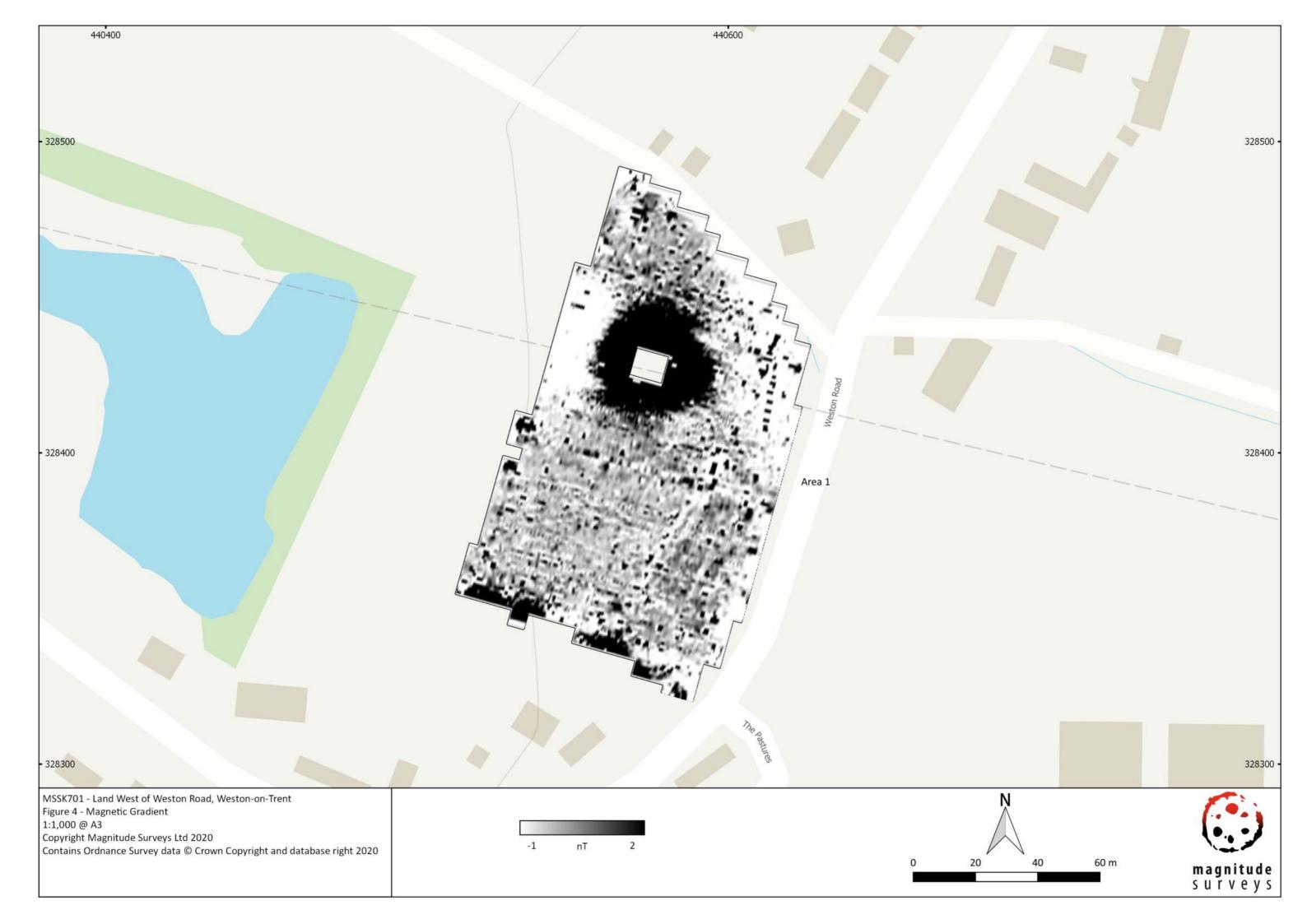
# 13. Document History

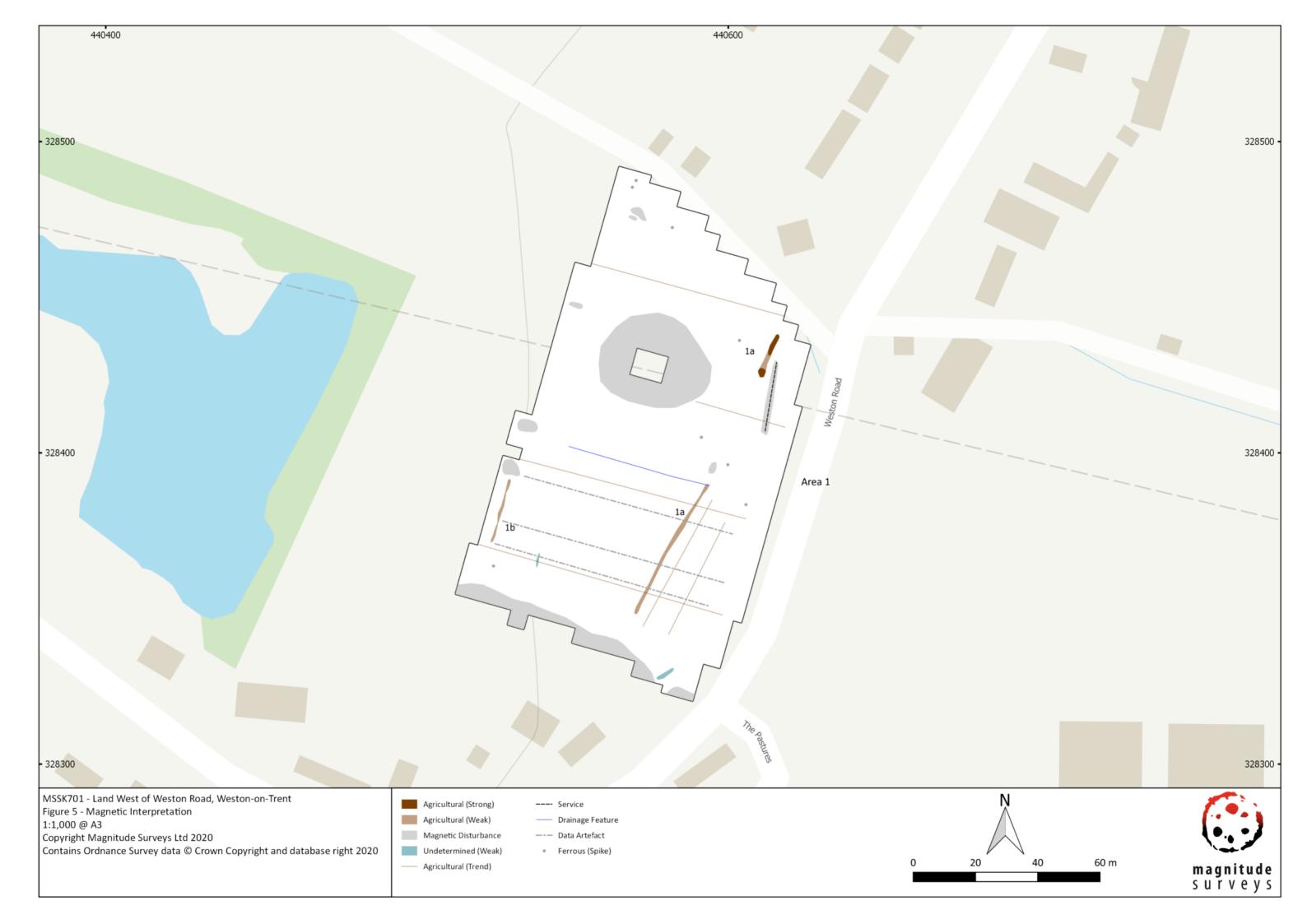
Version	Comments	/	Author	Checked By	Date
0.1	Initial draft for Project Officer		MC	LB	01 July 2020
, J	to Review				
0.2	Corrections from Project		MC	LB	02 July 2020
	Officer for Review				
0.3	Draft for Director sign off		IC	KA	03 July 2020
0.4	Corrections from Client		LB	CH	06 July 2020
1.0	Approved as Final		LB	KA	31 July 2020



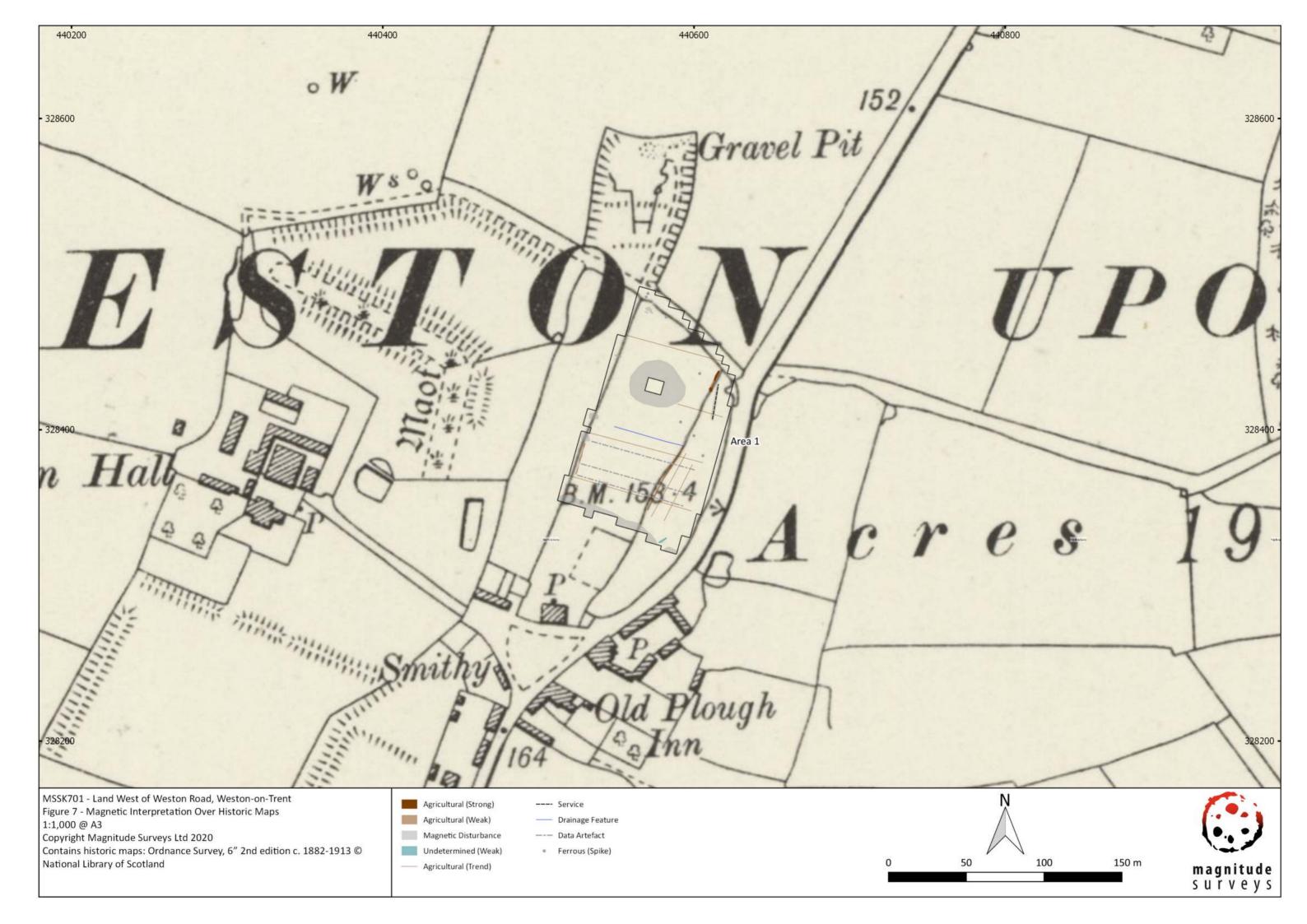


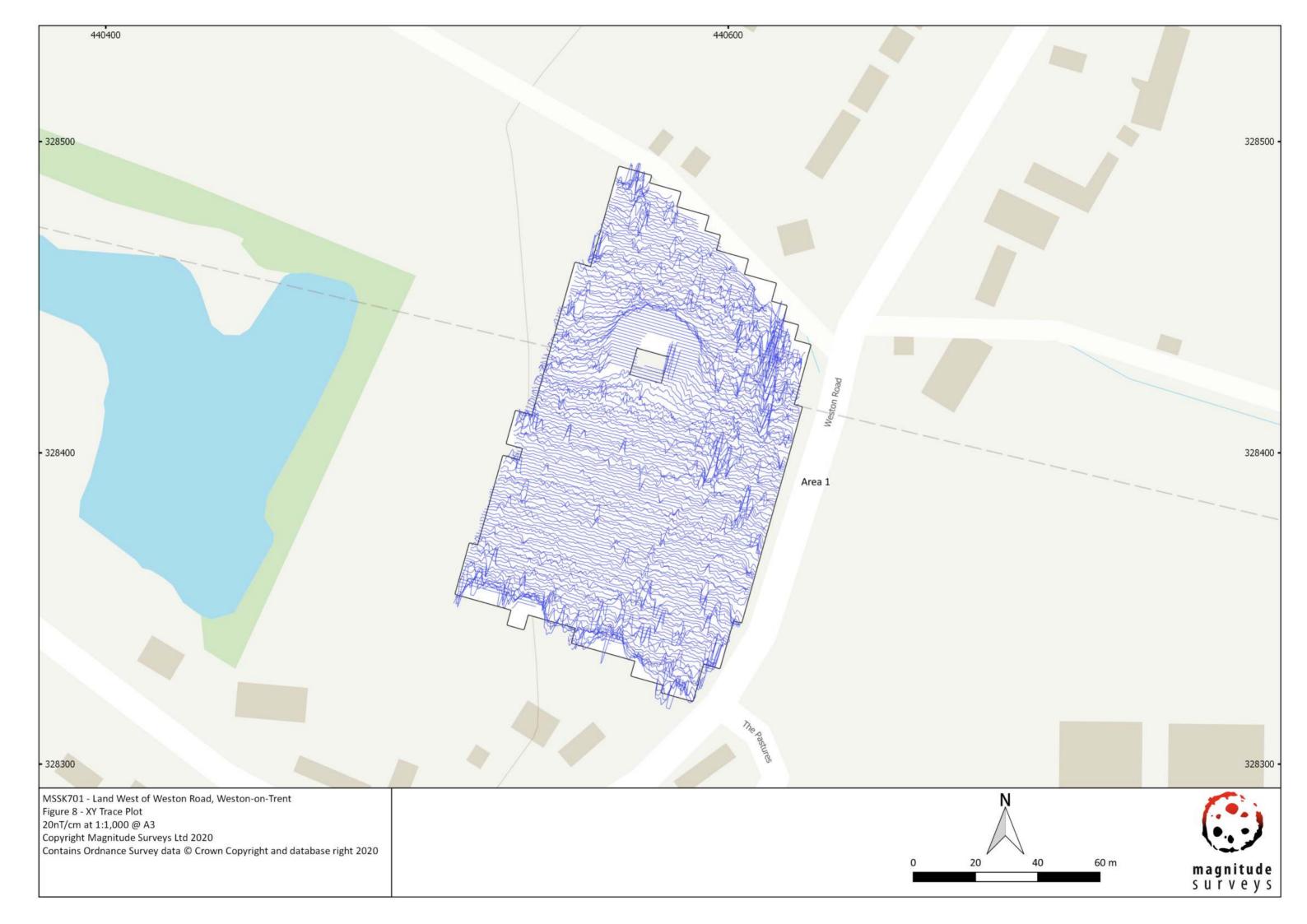












# **OASIS DATA COLLECTION FORM: England**

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#### **Printable version**

#### OASIS ID: magnitud1-400354

#### **Project details**

Project name Geophysical Survey Report of Land West of Weston Road, Weston-on-Trent

Short description of the project

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a c. 1.17ha area of land west of Weston Road, Weston-on-Trent, South Derbyshire. A fluxgate gradiometer survey was successfully completed across the survey area. The geophysical survey has primarily detected agricultural activity in the form of two former field boundaries, ploughing and drainage features. Anomalies of undetermined origins have also been identified within the survey area; the size of the survey area has limited a clear interpretation of these anomalies. These may relate to modern or agricultural activity and there is nothing in the geophysical survey results to suggest that these anomalies represent significant archaeological features. The impact of modern activity can be seen in the form of the magnetic halo caused by the pylon within the survey area and those of the houses that border the area.

Project dates Start: 19-06-2020 End: 31-07-2020

Previous/future

work

Not known / Not known

Any associated project reference codes

MSSK701 - Contracting Unit No.

Type of project Field evaluation

Current Land use Cultivated Land 4 - Character Undetermined

Monument type FIELD BOUNDARY Post Medieval

Significant Finds NONE None

Methods & techniques

"Geophysical Survey"

Development type Not recorded

Prompt Unknown

Position in the planning process

Not known / Not recorded

Solid geology (other)

Gunthorpe Member Mudstone

Drift geology GLACIAL SAND AND GRAVEL

Drift geology

(other)

Etwall sand and gravel

Techniques Magnetometry

#### **Project location**

Country England

Site location DERBYSHIRE SOUTH DERBYSHIRE WESTON UPON TRENT Land West of Weston

Road, Weston-on-Trent

Postcode **DE72 2BH** 

Study area 1.17 Hectares

Site coordinates SK 4054 2840 52.851244764392 -1.397926579 52 51 04 N 001 23 52 W Point

Lat/Long Datum Unknown

#### **Project creators**

Name of Organisation Magnitude Surveys Ltd

Project brief

Pegasus Group

originator

Project design originator

Magnitude Surveys Ltd

Project

Chrys Harris

director/manager Project supervisor

Type of

Andres Perez Developer

sponsor/funding

body

## **Project archives**

Physical Archive

No

Exists?

Digital Archive recipient

Derbyshire HER

Digital Archive ID

MSSK701

**Digital Contents** 

"Survey"

Digital Media available

"GIS", "Geophysics", "Text"

Paper Archive

Exists?

No

#### **Project** bibliography 1

Grey literature (unpublished document/manuscript)

Publication type

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