FENWICK SOLAR FARM

Fenwick Solar Farm EN010152

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Geophysical Survey Report

of

Fenwick Solar Farm Scheme,

Doncaster, South Yorkshire

For AECOM

Magnitude Surveys Ref: MSSE1569

HER Event Number: TBC

November 2024



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Abstract

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a c. 376.6 ha area of land at Fenwick, South Yorkshire. A fluxgate gradiometer survey was conducted between May and October of 2023. The survey has identified multiple anomalies of probable archaeological origin in the form of rectilinear enclosures, ring ditches, and trackways. Further anomalies of a possible archaeological origin have been identified in the form of possible enclosures and further linear features. Agricultural activity was identified in the form of mapped and unmapped former field boundaries and ridge and furrow cultivation, as well as modern ploughing regimes and drainage features. An anomaly related to a possible former infilled pit has been identified in the south of the survey area. Natural variations in the subsurface geology have been identified, as well as a mapped former river course to the north of the survey area. Modern interference is generally limited to field boundaries, buried services, pylons, and overhead cables. Spreads of green waste were detected across the south of the survey area and may have obscured weaker anomalies, if present.

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1. Introduction

- 1.1. Magnitude Surveys Ltd (MS) was commissioned by AECOM to undertake a geophysical survey over a c. 407.86ha area of land near to Fenwick, Doncaster (SE 6143 1614).
- 1.2. The geophysical survey comprised a quad-towed, cart-mounted and hand-carried GNSS-positioned fluxgate gradiometer survey. Magnetic survey is the standard primary geophysical method for archaeological applications in the UK due to its ability to detect a range of different features. The technique is particularly suited for detecting fired or magnetically enhanced features, such as ditches, pits, kilns, sunken featured buildings (SFBs) and industrial activity (David et al., 2008).
- 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 (ClfA, 2020) and the European Archaeological Council (Schmidt *et al.*, 2015).
- 1.4. It was conducted in line with a WSI produced by MS (Dolan, 2023).
- 1.5. The survey was completed intermittently over several months as areas became available to access and conditions became favourable, commencing on 30/05/2023 and finishing on 07/10/2023. An area c. 31.24ha in size was descoped with the remaining survey totalling c. 407.86ha in size.

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 for Archaeological Prospection).
- 2.2. The directors of MS are involved in cutting edge 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 has served as 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 Paul Johnson has a PhD in archaeology from the University of Southampton, is a Fellow of the Society of Antiquaries of London and a Member of CIfA, has been a member of the ISAP Management Committee since 2015, and is currently Char of the Archaeological Prospection Community of the European Archaeological Association.
- 2.3. All MS managers, field and office staff have degree qualifications relevant to archaeology or geophysics and/or field experience.

3. Objectives

3.2. 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. 500m east of Fenwick, Doncaster (Figure 1). Gradiometer survey was undertaken across 39 fields under arable cultivation and pasture. The survey area was bordered to the north by the River Went, to the south and west by further fields, and to the east by woodland and further fields (Figure 2). The survey area was bisected in the centre by further fields and a farm (Figure 2).

4.2. Survey considerations:

Survey Ground Conditions Further Notes Area		
Area		
	The area was bordered to the north, east and	
arable field, with spring bean west by a treeline, and to the so	-	
crop present. with hedgerows. A ditch and	I footpath were	
present oriented north-south	from the north	
boundary. A further ditch was o	riented along the	
south-eastern boundary.		
The area consisted of a flat The area was bordered to the n	orth and west by	
arable field. a treeline, and to the east and	-	
and treeline.	,	
3 The area consisted of a flat The area was bordered to the	north south and	
arable field, with young crop west by a treeline with hedge, a	•	
present. with young crop west by a tree-line with neage, a	-	
	rail along the	
northern boundary. 4 The area consisted of a flat The area was bordered to the	north cast and	
	· ·	
pasture field, with young cattle south by bushes and a barbed w		
present. the west by a barbed wire fence		
The area consisted of an The area was bordered to the i	•	
undulating pasture field. west by bushes and a barbed w		
the east by a treeline and barbe	ed wire fence.	
6 The area consisted of a flat The area was bordered to the n	orth and east by	
pasture field. ditches, and to the west and s	south by barbed	
wire fencing.		
7 The area consisted of a flat The area was bordered to the i	north, south and	
pasture field. west by bushes and barbed wire	e fencing, and to	
the east by barbed wire fencing	;.	
8 The area consisted of an uneven The area was bordered in all dir		
pasture field, with young cattle and barbed wire fencing.	,	
present.		
9 The area consisted of a flat The area was bordered to the n	orth and east by	
pasture field. a treeline and ditch, and to the	•	
by a treeline with barbed wire for		
10 The area consisted of a pasture The area was bordered to the		
field which sloped down to the fencing and a river, to the sou	· ·	
north. metal and wooden fencing and		
boundary to the east. An area to		
was unable to be surveyed du	ue to overgrown	
vegetation and debris.		
The area consisted of a flat The area was bordered to the no	•	
pasture field. and barbed wire fencing, to the	e east and south	

		by bushes and barbed wire fencing, and to the west by a treeline and a wooden fence.
12	The area consisted of a flat pasture field.	The area was bordered to the north and east by a treeline with barbed wire fencing, and to the west and south by a ditch. A further ditch was oriented north-south in the west of the survey area, and overhead cables were oriented northeast-southwest in the east.
13	The area consisted of an uneven pasture field gradually sloping down from the north.	The area was bordered to the north and east by a treeline and barbed wire fence, and to the south and west by bushes and barbed wire fencing. A ditch was oriented north to south
		through the centre of the survey area.
15	This area consisted of a flat pasture field.	The area was bordered to the north and west by a chain link fence, to the south by a ditch, and had no physical boundary to the east.
16	The area consisted of a flat pasture field.	The area was bordered by hedgerows and trees and had no physical boundary to the south. Farm equipment was present in the south of the survey area.
17	The area consisted of flat grassland on the edge of an arable field.	The survey area had no physical boundary to the west and southwest other than crop and was bordered by hedgerows in all other directions.
	diddle field.	The survey was bisected in the north by hedgerows on a northeast to southwest alignment. Overhead cables were oriented northeast to south through the northeast of the survey area.
18	The area consisted of flat grassland on the edge of an arable field.	The area had no physical boundary other than crop to the north and west and was bordered by hedgerows to the south and east. A pylon was present in the east of the survey area with telegraph poles on a northeast to south orientation.
19	The area consisted of a flat pasture field.	The survey area was bordered in all directions by hedgerows and a treeline. A vehicle was parked within the survey area.
20	The area consisted of a flat arable field.	The area was enclosed to the east and west by ditches and occasional trees, the southern boundary was a fence with a metal gate at the south-west corner. There was an open boundary to the north-eastern section which leads to the River Went. The north-eastern section of the area was partitioned from the rest of the area by a fence. The west boundary of the same section was a tree line. The remaining north boundary was a hedgerow.
21	The area consisted of a flat arable field.	The area was enclosed to the east and west by ditches and hedgerows. The northern area is an open boundary leading to the River Went. The

_		
		southern boundary was partially open to the west and enclosed by a treeline to the east.
22	The area consisted of a flat	The area had no physical boundary to the south
	pasture field.	and was enclosed by hedgerows and trees to the north, east and west. Farming equipment was
		located near the southern boundary.
23	The area consisted of a flat	The area had no physical boundary to the north
	arable field.	and south but was enclosed by hedgerows, trees
		and ditches on both the east and west boundaries.
24	The area consisted of a flat	The area had no physical boundaries to the north
	arable field.	and east, with the occasional trees. The
		boundary areas to the west and south were hedgerows and trees, with a ditch.
25	The area consisted of a flat	The area was enclosed to the north, east and
	arable field.	south by hedgerows and trees, whilst to the west
		is an open border with a farm on the south-west
		boundary. Beyond the southern hedgerow is a
26	The area consisted of a flat	minor road. In the northern hedgerow is a ditch. The area was enclosed on all boundaries by
20	arable field.	hedgerows and trees, except for part of the
		northern boundary which was open to a
		grassland area.
27	The area consisted of a flat arable field.	The area was enclosed on all boundaries by hedgerows and trees.
28	The area consisted of a flat	The area was enclosed on all boundaries by
	arable field.	hedgerows with some trees on the east and south boundaries. A farmyard and buildings
		were located on the southern boundary with
		some debris in the south-west corner of the site.
29	The area consisted of a flat	The area was enclosed on the north and east by
	arable field.	hedgerows containing trees and ditches, the
		southern boundary was lined with trees with a private road behind. West of the area was
		enclosed with a ditch.
30	The area consisted of a flat, but	The area was enclosed on the east by a
	bumpy, arable field which had	hedgerow, a minor road to the west and no
	been harvested.	boundary immediately to the north where
		another un-surveyed field is located. The southern boundary was marked by an electric
		fence. Within the area a small part of land was
		un-surveyable due to a mound of manure
		located near to the northern boundary.
31	The area consisted of a flat arable field.	The area was enclosed to the north by a hedgerow and ditch, north-east was an open
	arable field.	boundary where as the south-east boundary was
		a farmstead, the southern boundary was also a
		hedgerow and the west boundary was a tree line
		until the north-west when it became a small
		wooded area. An electricity pylon was in the centre of the area with the overhead cables
		centre of the area with the overhead Cables

		coming into the field from the east to the centre	
		then exiting the area in the south.	
The area consisted of a flat silage field.		The area was enclosed on all boundaries by hedgerows and trees. On the southern boundary was residential buildings.	
The area consisted of a flat arable field.		The area was bordered by a farm track to the north and east and by hedges to the west and south. A small area in the southeast was unable to be surveyed due to ground conditions.	
34	The area consisted of a flat arable field.	The area was bordered by hedges and trees on all sides.	
35	The area consisted of a flat arable field.	The area was bordered by hedges and trees to the west and east. A small hedge separated the	
		area from a farm track to the south. Several piles of dirt were present within the survey area, adjacent to a track that ran north throughout the area.	
36	The area consisted of <mark>a f</mark> lat arable field.	The area was bordered by a farm track to the south and hedges and trees on all other sides.	
37	The area consisted of a dry, recently disced field.	The area was bordered by trees and hedges on all sides.	
38	The area consisted of a dry, recently disced field.	The area was bordered by trees and hedges on all sides. Environmental crop was present along the western and northern edges of the survey area, and was unable to be surveyed. Scrap metal from the neighbouring farm yard was present in the southeastern corner.	
39	The area consisted of a flat, arable field.	The area was bordered on all sides by hedgerows.	

- 4.3. The underlying geology comprises sandstone of the Sherwood Sandstone Group. Superficial deposits comprise silty clays of the Hemingbrough Glaciolacustrine Formation across the majority of the survey area, with bands of alluvium in the north of Areas 10 & 15, and the south of Areas 6 & 12, and bands of sand of the Breighton Sand Formation in Areas 9, 11, 12, 13, 29 & 31(British Geological Survey, 2024).
- 4.4. The soils consist of slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (Soilscapes, 2024).

5. Archaeological Background

- 5.1. The following is a summary of a Historical event report produced by North Yorkshire Council and provided by AECOM (Goldsmith, 2023).
- 5.2. A scatter of Neolithic flints were recorded c. 1.3km northeast of the survey area. Two upper stones of beehive querns, one of which has characteristic of the Yorkshire style of Iron Age Querns, were recorded c. 950m north of the survey area. Two further rotary quern stones, thought to be Romano-British in origin, were recorded c. 900m northwest of the survey area. Cropmarks identified through aerial photographs were recorded c. 730m north of the survey

- area, indicative of two possible Romano-British enclosures of a rectangular and sub-circular morphology.
- 5.3. HER data has recorded Moat hill c. 1.9km west of the survey area, This was a moated medieval site and fishpond in close proximity to known ridge and furrow and a pottery scatter. Fenwick Hall, a medieval moated site is located c. 140m west of the survey area. Holy Trinity Church, an 18th-century church is located 1.2km east of the survey area and stands upon the location of a 15th-century chapel. Earthworks possibly indicative of a moated site were recorded c. 420m east of the survey area, along with evidence of medieval ridge and furrow ploughing. Further earthworks indicative of a possible moated site were recorded c. 170m north of wood farm. Cropmarks thought to be related to 13th-century occupation have been recorded c. 730m north of the survey area.
- 5.4. A series of undated banks, ditches, and earthworks, possibly related to drainage features were recorded c. 780m east of the survey area.

6. Methodology

6.1 Data Collection

- 6.2.1.Magnetometer surveys are generally the most cost effective and suitable geophysical technique for the detection of archaeology in England. Therefore, a magnetometer survey should be the preferred geophysical technique unless its use is precluded by any specific survey objectives or the site environment. For this site, no factors precluded the recommendation of a standard magnetometer survey. Geophysical survey therefore comprised the magnetic method as described in the following section.
- 6.2.2.Geophysical prospection comprised the magnetic method as described in the following table.
- 6.2.3. 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

- 6.2.4.The magnetic data were collected using MS' bespoke quad-towed cart system and hand-carried GNSS-positioned system.
 - 6.2.4.1. MS' cart and 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.
 - 6.2.4.2. 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.

6.2.4.3. 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.

6.3. Data Processing

6.3.1.Magnetic data were processed in bespoke in-house software produced by MS. Processing steps conform to the EAC and Historic England guidelines for 'minimally enhanced data' (see Section 3.8 in Schmidt *et al.*, 2015: 33 and Section IV.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.

6.4. Data Visualisation and Interpretation

- 6.4.1.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 of the gradient and total field at different plotting ranges have been used for data interpretation. Greyscale images should be viewed alongside the XY trace plots (Figures 29, 32, 35, 38, 41, 44, 47, 50, 53, 56, 59, 62, 65, 68, 71, 74, 77, 80, 83, 86, 89, 92, 95, 98, 101, 104, 107, 110, 113, 116, 119, 122). XY trace plots visualise the magnitude and form of the geophysical response, aiding anomaly interpretation.
- 6.4.2.Geophysical results have been interpreted using greyscale images and XY traces in a layered environment, overlaid against open street maps, satellite imagery, historical maps, LiDAR data, and soil and geology maps. Google Earth (2024) was also consulted, to compare the results with recent land use.
- 6.4.3.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

7.2.Qualification

7.2.1.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 from further work, in order to constantly improve our knowledge and service.

7.3.Discussion

- 7.3.1.The geophysical results are presented in combination with satellite imagery and historical maps (Figures 5, 8, 11, 14, 17 and 20). A fluxgate gradiometer survey was successfully undertaken across c. 376.6ha. The survey generally reacted well to environment of the survey area, though spreads of green waste are present in the south of the survey area that may obscure weaker anomalies within the area if present. Modern interference is generally limited to field boundaries, services and overhead cables. Anomalies of probable and possible archaeological origin have been identified throughout the survey area. Further anomalies of agricultural, natural and undetermined origin have been identified, as well as an anomaly indicative of an infilled pit.
- 7.3.2.Multiple sets of anomalies of probable archaeological origins have been identified within eight different foci across the survey area (Figures 5, 8, 11, 17 and 20). These anomalies present a range of different signal strengths and morphologies indicative of rectilinear and sub-circular enclosures, with internal subdivisions and external features, located within the centre and northwest of the survey area.
- 7.3.3.Possible archaeological anomalies have been recorded in proximity to these foci, and elsewhere within the survey area. While these anomalies may present similar morphologies, they do not form easily recognisable features and present a weaker or negative signal (Figures 11, 17 and 20). These anomalies may be indicative of multiple partial enclosures or trackways due to their linear morphologies.
- 7.3.4.Historical agricultural activity has been recorded in the form of extensive ridge and furrow cultivation within the centre and north of the survey area (Figures 3 to 26). Former mapped field boundaries represented by linear and spread anomalies, which align with features observed on historical OS mapping have also been recorded (Figures 3 to 26), along with similar anomalies probably indicating the presence of unmapped former field boundaries. Modern agricultural activity has been recorded in the form of modern plough trends and drainage features have been identified throughout the survey area.

- 7.3.5.A very strong dipolar reading was recorded in the middle of a possible rectilinear and magnetic anomaly (Figures 108 & 109). This indicates to a previously mapped infilled pit which has been recorded in Area 1 of the survey area. This anomaly aligns with rectilinear cropmarks visible in previous satellite imagery of a possible pit that has been infilled with material which is not that of the surrounding area.
- 7.3.6. Natural variations in the subsurface geology and soils have been detected, as well as anomalies relating to a mapped former river course, visible in historical OS mapping in the north.
- 7.3.7. Throughout the survey area, anomalies have been identified which lack the contextual evidence needed for a confident classification. Although these are likely agricultural, natural, or modern in origin, an archaeological origin cannot be ruled out.

7.4.Interpretation

7.4.1. General Statements

- 7.4.1.1. Geophysical anomalies will be discussed broadly as classification types across the survey area. Only anomalies that are distinctive or unusual will be discussed individually.
- 7.4.1.2. Data Artefact Data artefacts usually occur in conjunction with anomalies with strong magnetic signals due to the way in which the sensors respond to very strong point sources. They are usually visible as minor 'streaking' following the line of data collection. While these artefacts can be reduced in post-processing through data filtering, this would risk removing 'real' anomalies. These artefacts are therefore indicated as necessary in order to preserve the data as 'minimally processed'.
- 7.4.1.3. **Ferrous (Spike)** Discrete dipolar anomalies are likely to be the result of isolated pieces of modern ferrous debris on or near the ground surface.
- 7.4.1.4. **Ferrous/Debris (Spread)** A ferrous/debris spread refers to a concentration of multiple discrete, dipolar anomalies usually resulting from highly magnetic material such as rubble containing ceramic building materials and ferrous rubbish.
- 7.4.1.5. **Magnetic Disturbance** The strong anomalies produced by extant metallic structures, typically including fencing, pylons, vehicles, and service pipes, have been classified as 'Magnetic Disturbance'. These magnetic 'haloes' will obscure weaker anomalies relating to nearby features, should they be present, often over a greater footprint than the structure causing them.
- 7.4.1.6. **Undetermined** Anomalies are classified as Undetermined when the origin of the geophysical anomaly is ambiguous and there is no supporting contextual evidence to justify 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 distinct from those caused by ferrous sources.

7.4.2. Magnetic Results - Specific Anomalies

- 7.4.2.1. Archaeology Probable (Weak & Strong) Within the survey area, 7 foci of probable archaeology across Areas 5, 7, 8, 9 and 12, 23 and 24 series of linear and curvilinear anomalies of moderate positive magnetic enhancement, have been recorded which are indicative of rectilinear enclosures, presenting internal subdivisions and external features [5a, 5b, 7a, 8a, 9a, 9c, 12a, 23a & 24a] (Figures 28, 37, 43, 64, 70, 73, 76, 85, 88, 94, and 118). Within Area 9 two foci have been identified, in the form of a rectilinear enclosure to the north measuring c. 48m by 44m with internal subdivisions and external linear features [9c], as well as a smaller rectilinear enclosure measuring c. 23m by 23m and presenting a similar but more dispersed signal [9a] to the east. This secondary enclosure contains a subcircular anomaly indicative of a ring ditch, as well as linear features to its south indicative of a double ditch trackway [9b].
- 7.4.2.2. Archaeology Probable (Weak & Strong) Further east, within the north of Area 12, a rectilinear enclosure measuring c. 62m by 22m has been identified [12a], which presents a stronger but equally dispersed signal to [9b] (Figure 64). South of these, within Area 8, a further rectilinear anomaly has been identified [8a], measuring c. 32m by 33m, which contains a subcircular anomaly indicative of a ring ditch in its centre. This focus presents a much weaker signal than those to the north [12a, 9a, 9c], and is accompanied of further weak linear anomalies to its immediate north that may be a partial enclosure. Similar anomalies [23a & 24a] are present within Areas 23 and 24, consisting of several rectilinear anomalies surrounding a circular enclosure, such as [23a], or a series of curvilinear anomalies [24a]. Within Area 5, a rectilinear enclosure measuring c. 105m by 55m has been identified [5a], which presents a similar signal to [8a] and also contains a ring ditch [5b], as well as further external curvilinear anomalies to its southwest. Within the centre of the survey area, in Area 7, a small rectilinear enclosure measuring c. 14m by 15m, containing a ring ditch has been identified [7a] (Figure 88). This enclosure presents the weakest signal of all the archaeological foci, and indicates the presence of external linear features, as well as two parallel linear anomalies c. 38m to its north which are indicative of a double ditch trackway [7b].
- 7.4.2.3. Archaeology Probable and Possible (Strong & Weak)—In the northwestern corner of Area 26, several linear, curvilinear and discrete anomalies [26a] have been identified. These anomalies display a weakly positive magnetic signal and form partial enclosures to the east and west of a much stronger semi-linear feature that runs north to south [26b] (Figure 28). This stronger linear anomaly has unusual morphology and a stronger magnetic signal than the other nearby archaeological anomalies, but its proximity suggests that it could be of archaeological origin. On the western side of this stronger feature, several discrete anomalies are located within the curvilinear anomalies of the partial enclosure [26a].
- 7.4.2.4. **Archaeology Possible (Weak & Strong)** Numerous linear, curvilinear and discrete anomalies of weak to moderate positive enhancement were recorded across Areas 4, 5, 6, 7, 8, 9, 12, 13, 20 and 36 (Figures 52, 61, 67, 70, 73, 76, 85, 88, 97, 100 &

- 112). Within several of these areas, particularly Areas 4, 5, 6, 7 and 12 these anomalies lie in close proximity to several areas of probable archaeology, and may represent extensions of this activity, but exhibit weaker signals or unusual morphologies that hinder their classification. In the south of the survey area, one area of focus [36a] is distinct, and doesn't lie in proximity to any probable archaeological anomalies. The anomalies here are more discontinuous and discrete and, if they are of archaeological origin, have likely been affected by ploughing or other destructive processes.
- 7.4.2.5. Agricultural (Weak, Strong & Spread) Strong and weak, linear and curvilinear anomalies were identified in Areas 1, 7, 11, 12, 13, 19, 29, 31 35 and 37 (Figures 34, 37, 52, 58, 61, 73, 88 and 97). The majority of these anomalies coincide with field boundaries and ditches visible on historical OS mapping. Some anomalies, such as the weaker anomalies in Areas 13 & 19 are likely unmapped former field boundaries based on their location and morphology (Figure 58). Sometimes, these anomalies comprise a 'spread' of closely packed discrete anomalies, such as within Area 7 and 31, which align with field boundaries visible in Historical OS mapping (Figures 82 & 85). In these circumstances, it is likely that the field boundary has either been ploughed out, rather than infilled.
- 7.4.2.6. Industrial/Modern An amorphous anomaly with an extremely strong positive was identified in the west of Area 1 [1a] (Figure 109). It has clearly defined borders and a high contrast to surrounding signals suggesting an excavation infilled with material not local to the immediate area. This anomaly is visible as cropmarks within 2002 historical satellite imagery and relates to modern borehole drilling.
- 7.4.2.7. **Ridge and Furrow (Trend)** Several alignments of parallel linear and curvilinear anomalies possessing a strong positive enhanced signal have been identified in Areas 5, 7, 8, 11 and 13 in the northeast of the survey area, and are predominantly visible in the Total Field (Figures 9 & 12). These are indicative of historical ridge and furrow ploughing due to their morphology and general c. 5-8m spacing.
- 7.4.2.8. **Agricultural (Trend)** Across many of the fields within the survey area, several linear anomalies have been identified (Figures 67, 70, 76, 79, 82, 91, 94, 97, 112, 118 and 121). These anomalies are likely related to modern ploughing trends, and align with ploughing directions visible in satellite imagery.
- 7.4.2.9. **Drainage Feature** Across most of this zone, particularly in lower lying regions, alignments of strong and weak parallel linear anomalies have been identified. These anomalies are indicative of drainage features, with some anomalies exhibiting strong dipolar signals indicative of ceramic field-drains.
- 7.4.2.10. **Natural (Weak/Spread)** A few amorphous, moderately enhanced anomalies have been identified in Areas 1, 7, 9-10, 12, 15, 19 and 36 which are likely caused by variation in the soils and underlying geology (Figures 34, 37, 55, 61, 64, 67, 70, 73, 85, 94, 97, 100, 109, 112, 115 & 118). Within Areas 10 and 15 a spread of strong

and weak amorphous anomalies has been identified which align with a former river course recorded on historical maps (Figures 61 & 64).

7.4.2.11. **Undetermined (Weak & Strong)** – Across majority of the survey area, numerous linear curvilinear and amorphous anomalies have been identified which are lacking any distinctive contextual evidence to their origin. This is particularly prevalent in Areas 1, 2 and 3 where the presence of 'green waste' may have obscured weaker anomalies (Figures 91 and 94). These anomalies may be of agricultural, natural, or modern in origin, however archaeological origins cannot be excluded.

8. Conclusions

- 8.1 A fluxgate gradiometer survey was successfully undertaken across a c. 376.6 ha area. The survey generally responded well to the environment of the survey area, although data quality has been affected in some areas due the spreading of green waste, low-hanging high voltage power cables in the east of the survey area and the presence of several areas of extant ridge and furrow within the northwest of the survey area. The survey has detected anomalies of probable and possible archaeological origin, as well as further anomalies of agricultural and natural origin, and an anomaly related to a modern infilled pit. Modern interference is generally limited to field boundaries, buried services and overhead cables.
- 8.2. Probable archaeological activity was identified across 7 foci within the survey area, in the form of ring ditches and rectilinear enclosures, with internal subdivisions and external features, as well as trackways. Further possible archaeological activity was identified in the form of possible partial rectilinear enclosures and linear features, often in close proximity to more probable archaeological features.
- 8.3. Agricultural activity has been recorded in the form of multiple mapped and unmapped former field boundaries and ridge and furrow cultivation. Modern agricultural activity has also been identified in the form of modern ploughing trends, farm tracks and drainage features.
- 8.4. An anomaly indicative of an infilled pit has been recorded in the southwest of the survey area.
- 8.5. Natural anomalies have been identified across the survey area, which likely relate to changes in the underlying geology and topography, as well as the route of former river course at the northern edge of the survey area.
- 8.6. Several anomalies thought the survey area have been classified as undetermined because it has not been possible to definitively determined whether these anomalies are the result of archaeological, agricultural, modern, or natural origins.

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 any dictated time embargoes.

10. Copyright

10.1. Copyright and 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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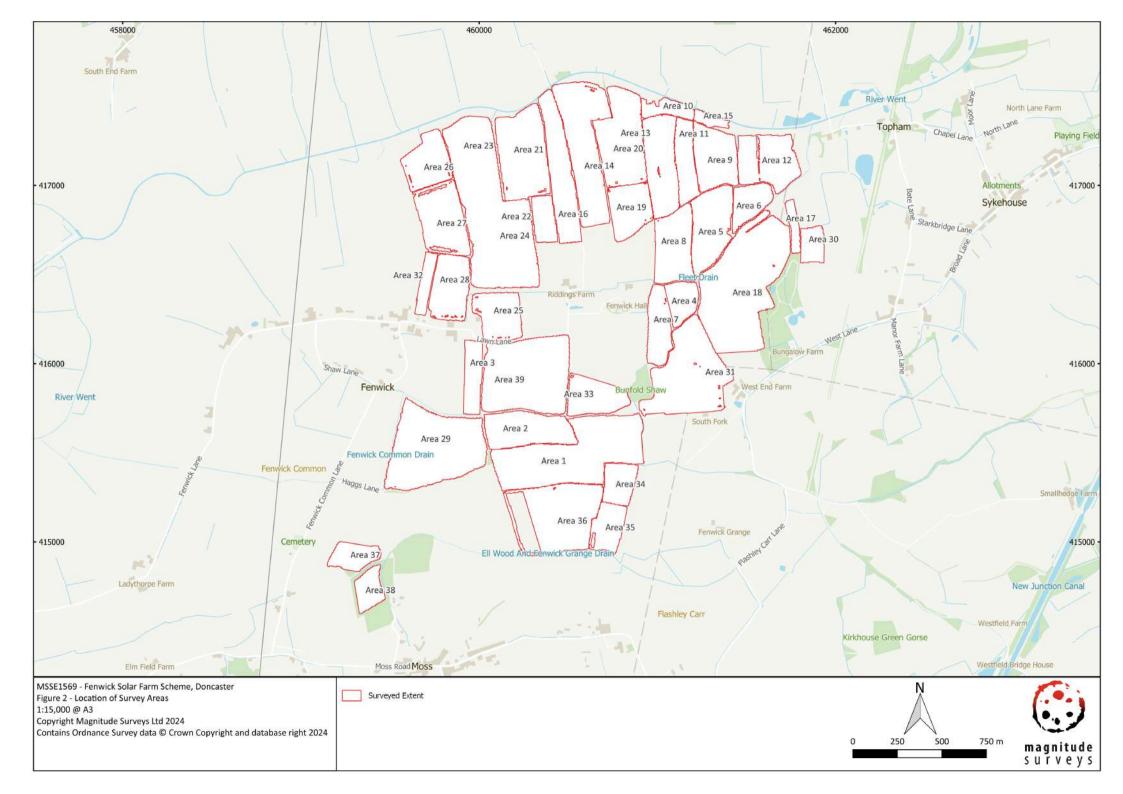
12. Project Metadata

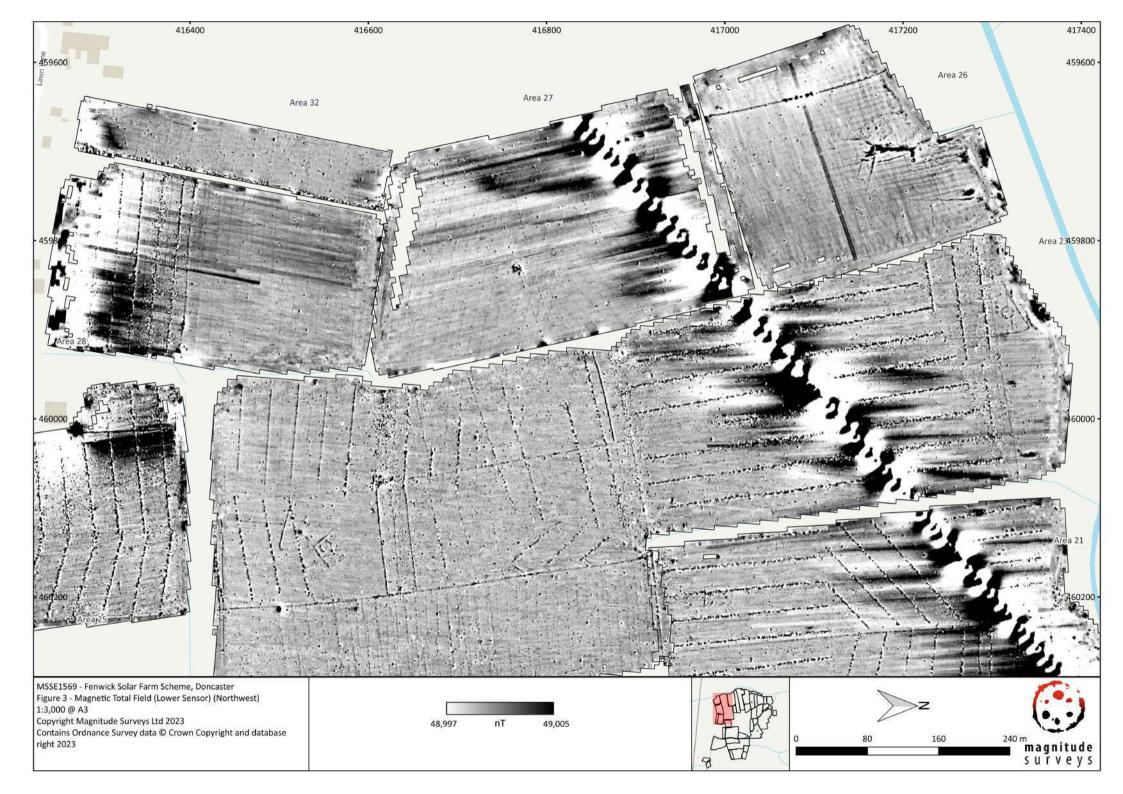
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Project Name	Fenwick solar Farm Scheme, Doncaster, South Yorkshire			
Client	AECOM			
Grid Reference	SE 6143 1614			
Survey Techniques	Magnetometry			
Survey Size (ha)	c. 376.6ha			
Survey Dates	rates 2023-05-30 (Currently Ongoing)			
Project Lead	Project Lead Jake Dolan BSc FGS, Isabella Carli BA MA PCIfA			
Project Officer	Jake Dolan BSc FGS, Isabella Carli BA MA PCIfA			
HER Event No	TBC			
OASIS No	N/A			
S42 Licence No	N/A			
Report Version	1.1			

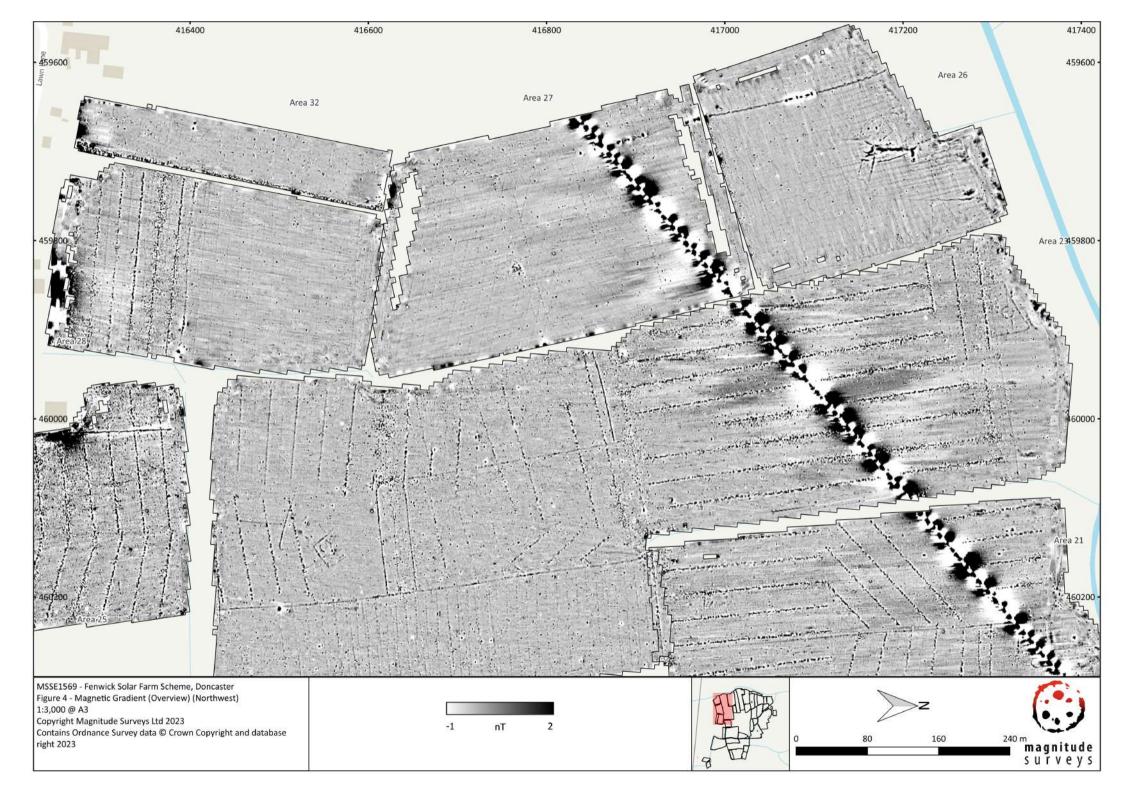
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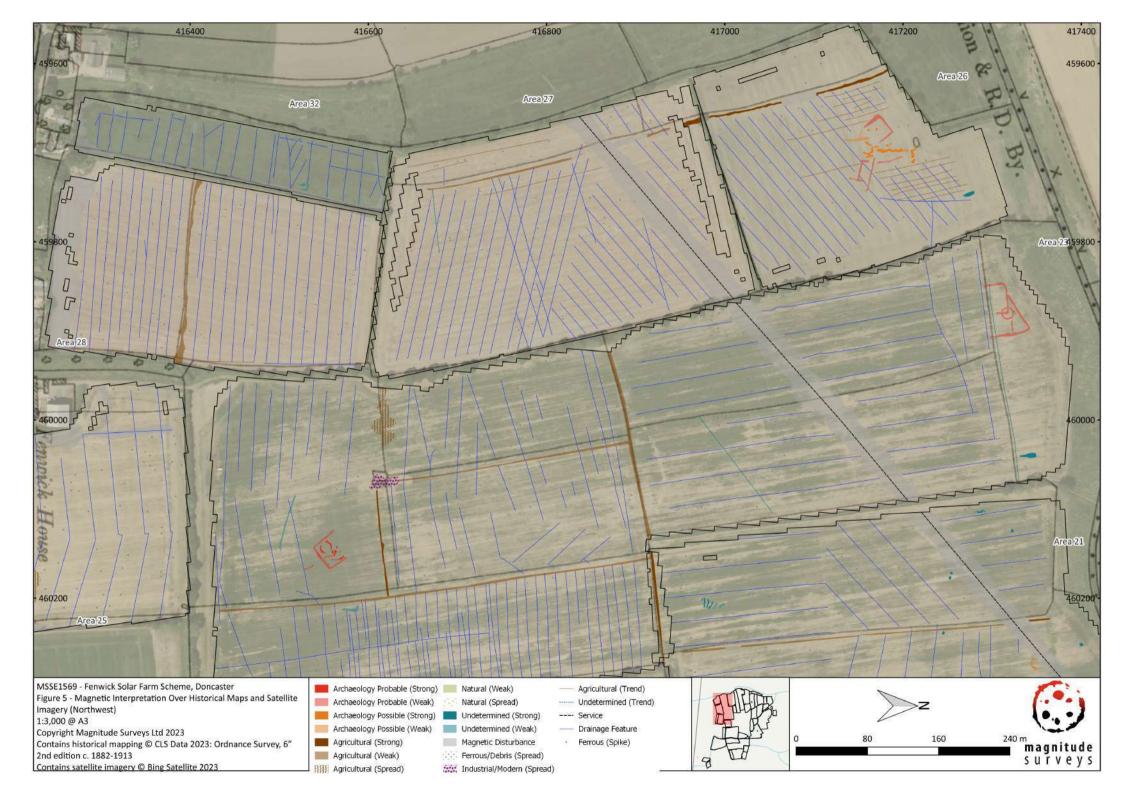
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Version	Comments	Author	Checked By	Date	
0.1	Initial draft for Project Lead	DN	AL	22 June	
	to Review			2023	
0.2	Secondary draft corrections	IT	AL	04 July 2023	
	from Project Officer				
0.3	Further corrections from	IT, MC			
	Project Officer				
0.4	Updating draft with further	ВО	PSJ	05	
	survey results			September	
				2023	
0.5	Updating draft with further	PV, JD	IC, FPC	17 October	
	survey results			2023	
0.6	Corrections following Project	JD	IC, FPC	19 October	
	Lead Review	()		2023	
1.0	Corrections to figures	MS	IC, FPC	20	
				November	
				2023	
1.1	Removed references to the	HA	IC	10	
	unsurveyable areas and to			April	
	any future re-deployments as			2024	
(7 <u>555</u>)	requested by the client				
1.1	Edits to Figure 2	IC	IC	3 September	
				2024	

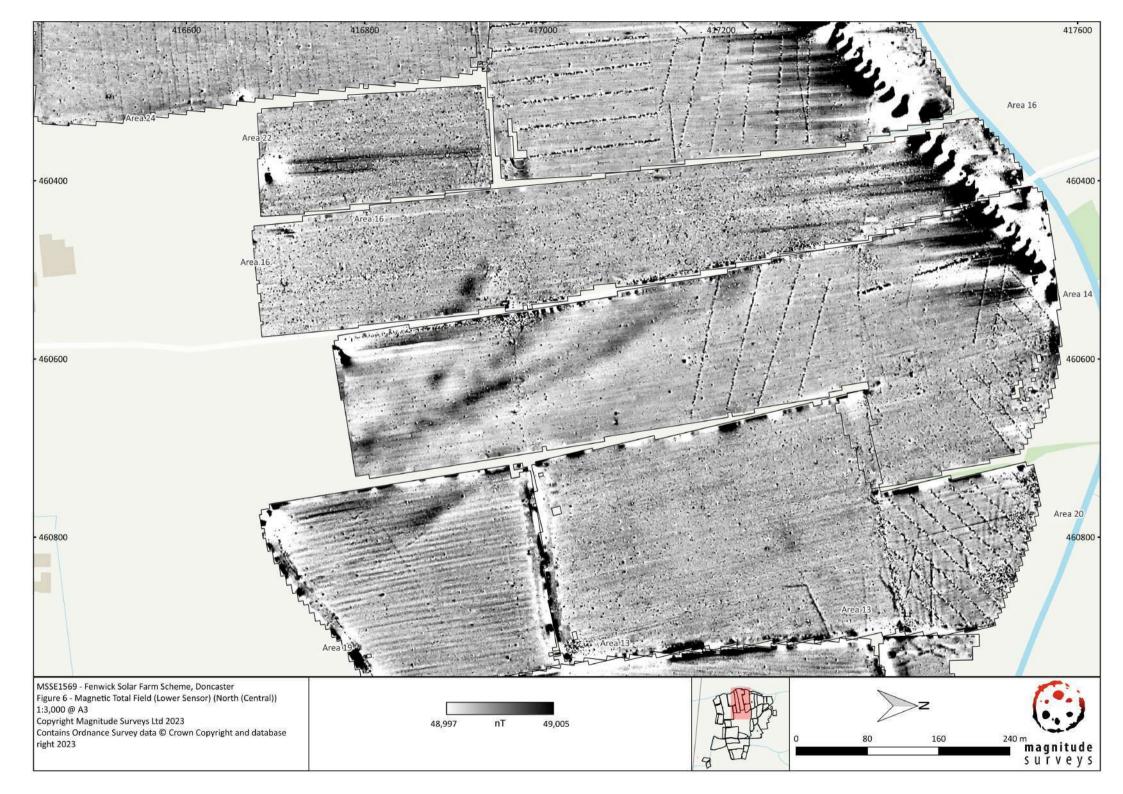


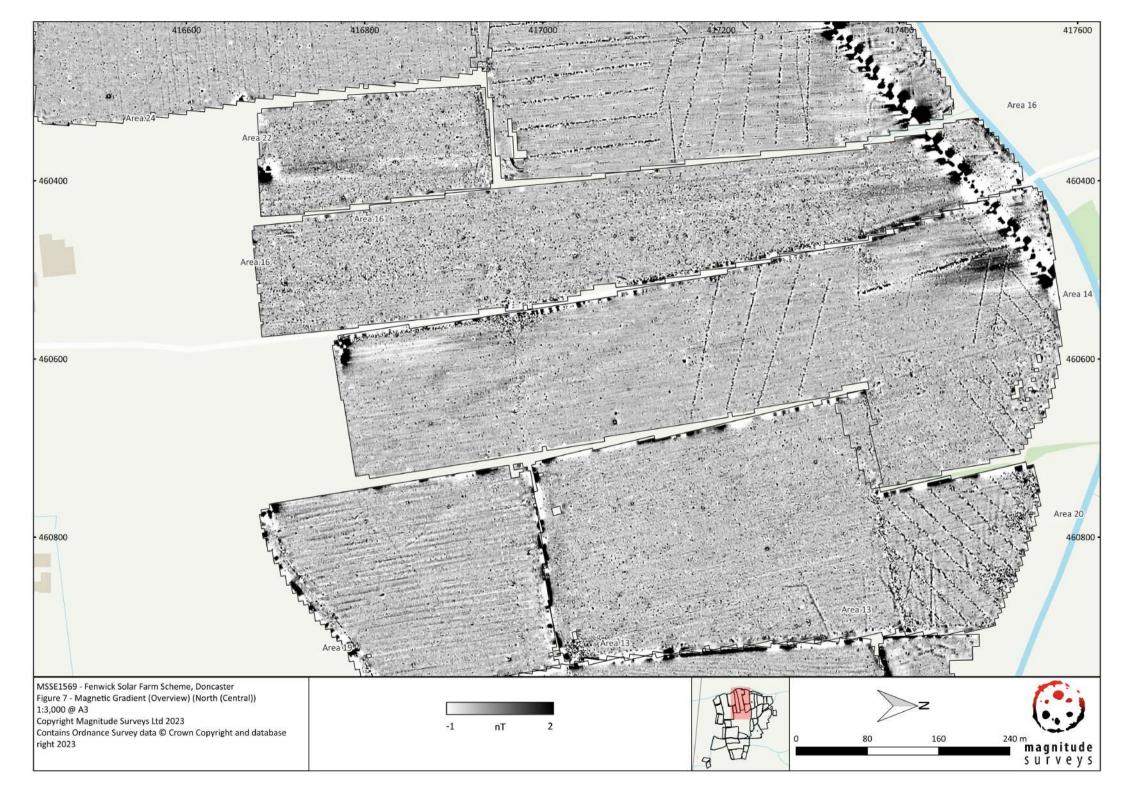




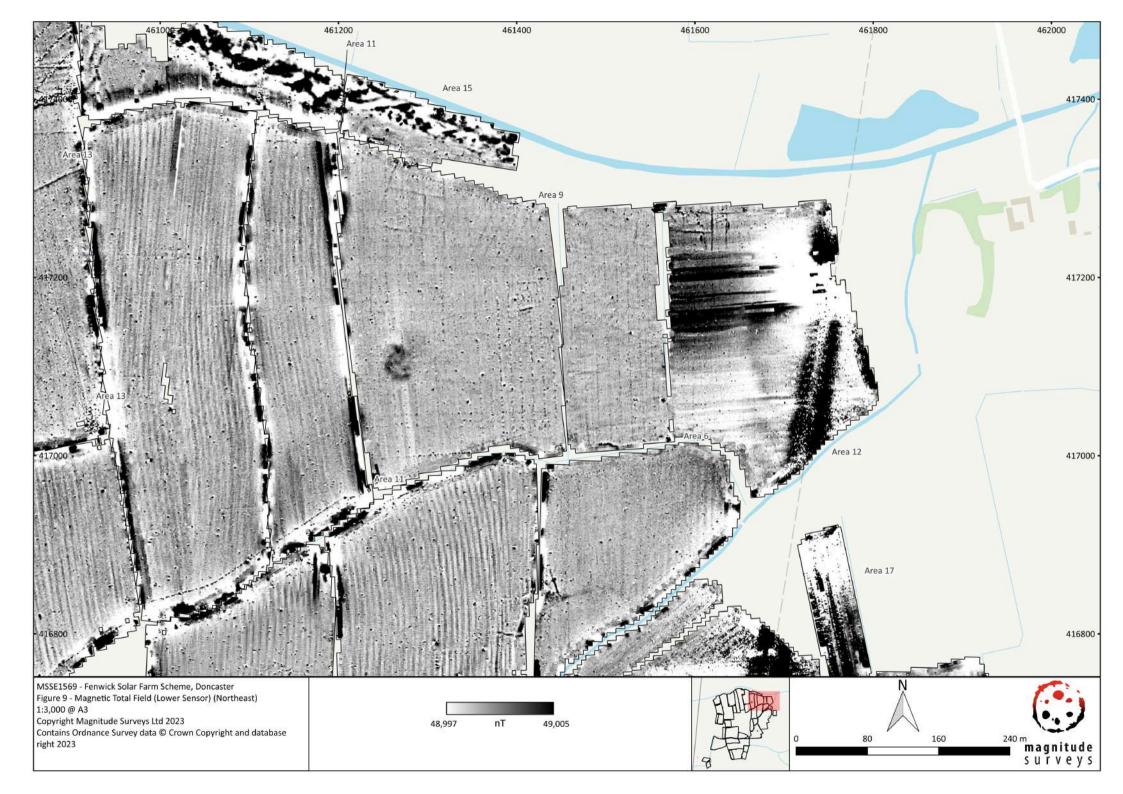


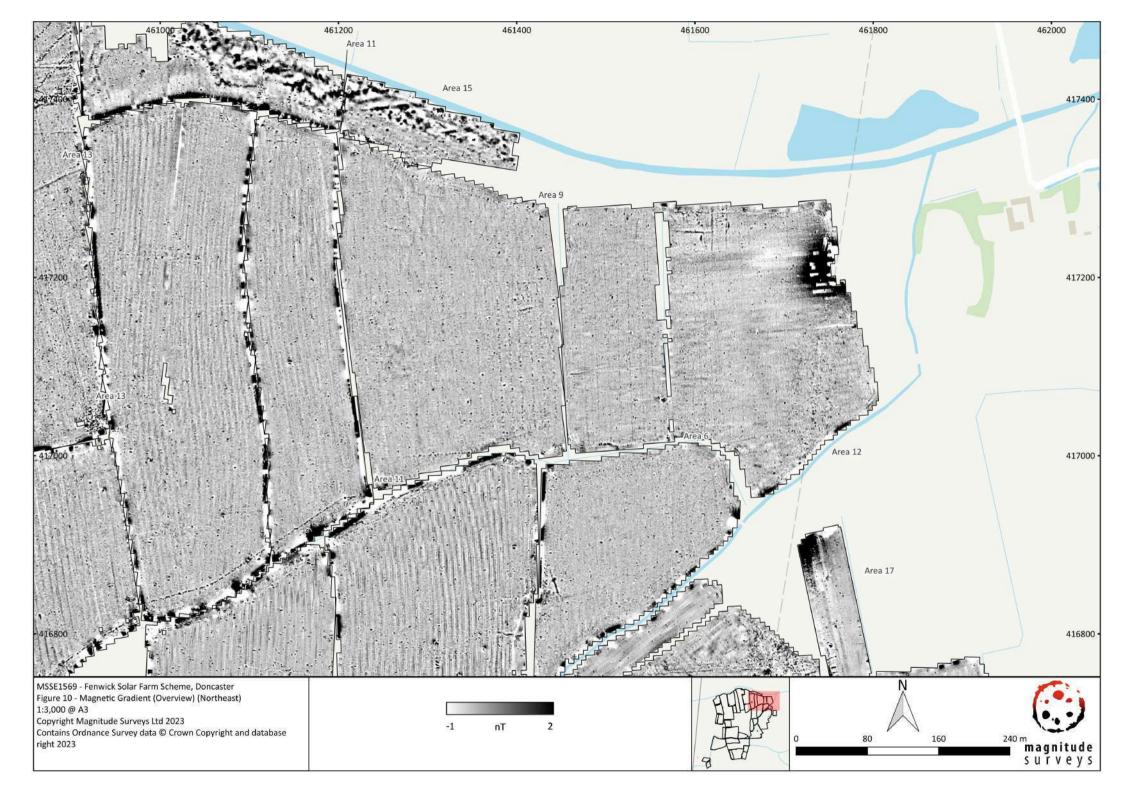


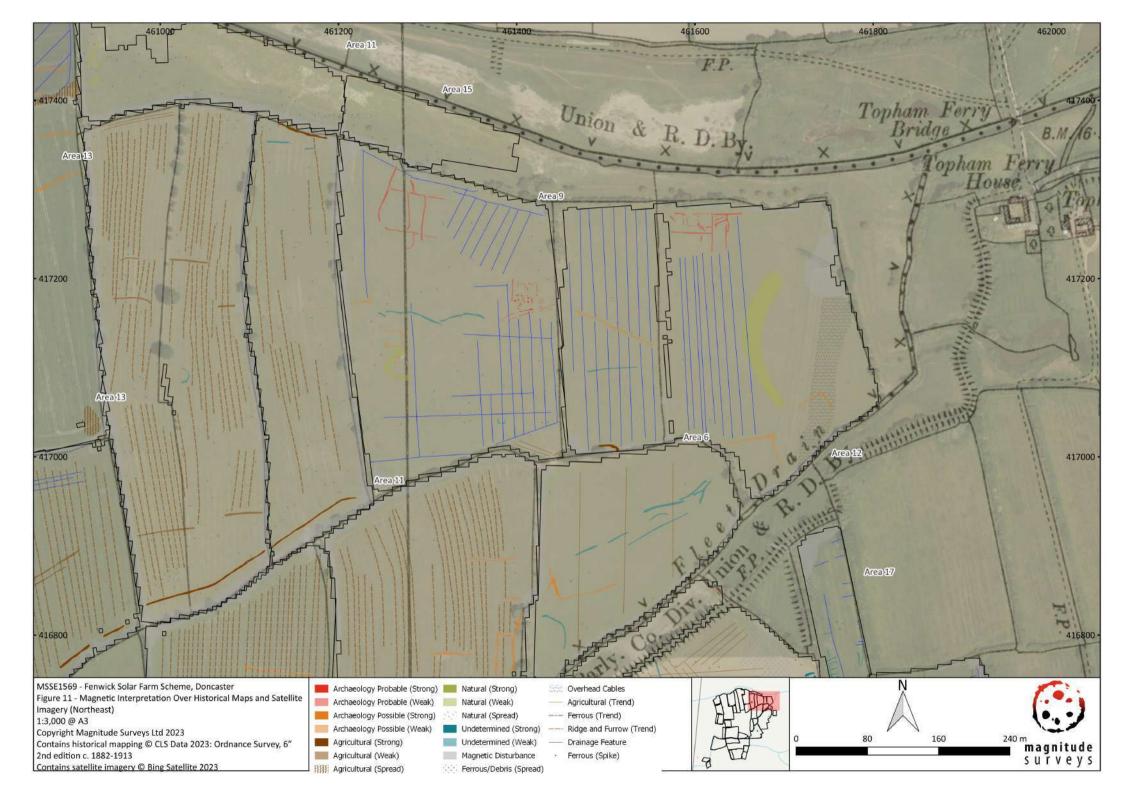


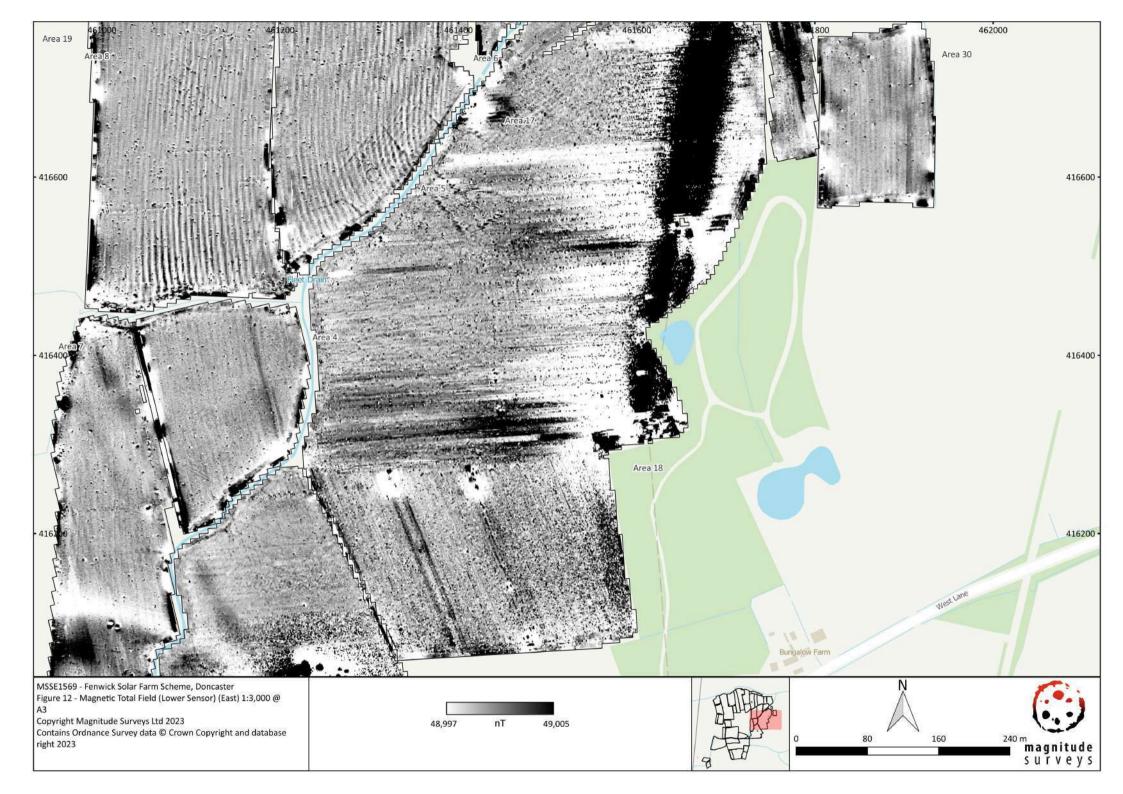


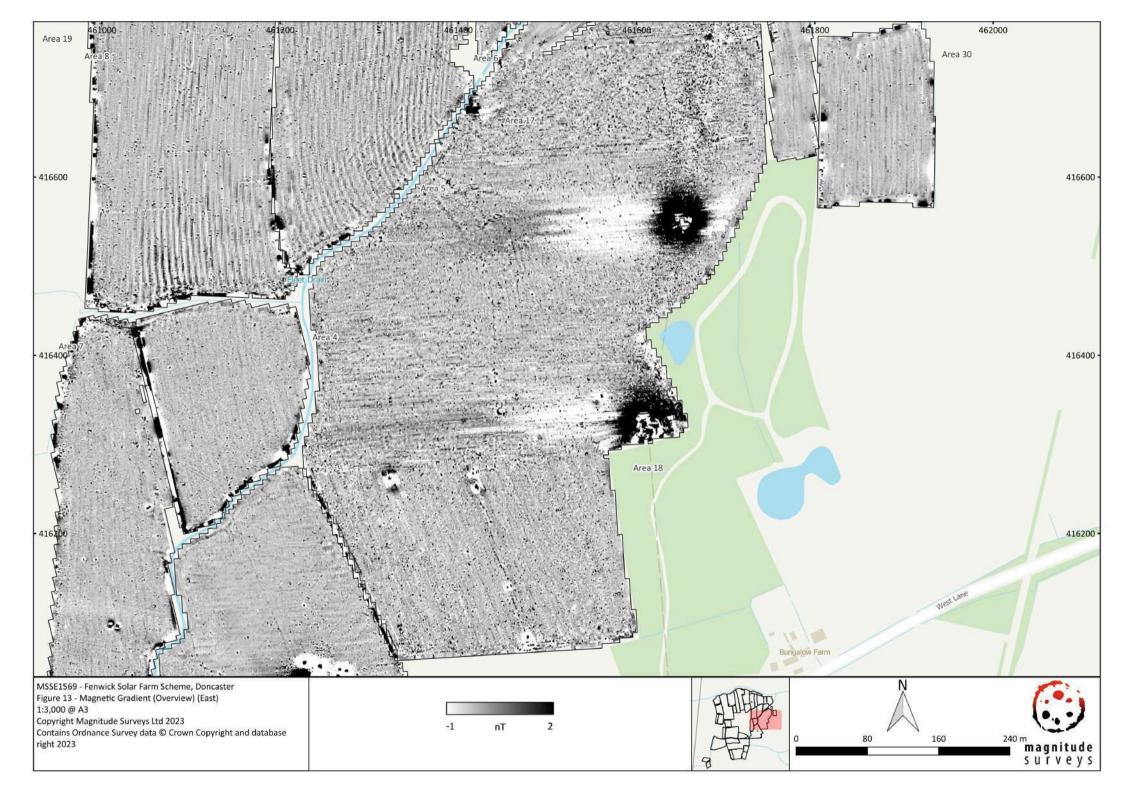


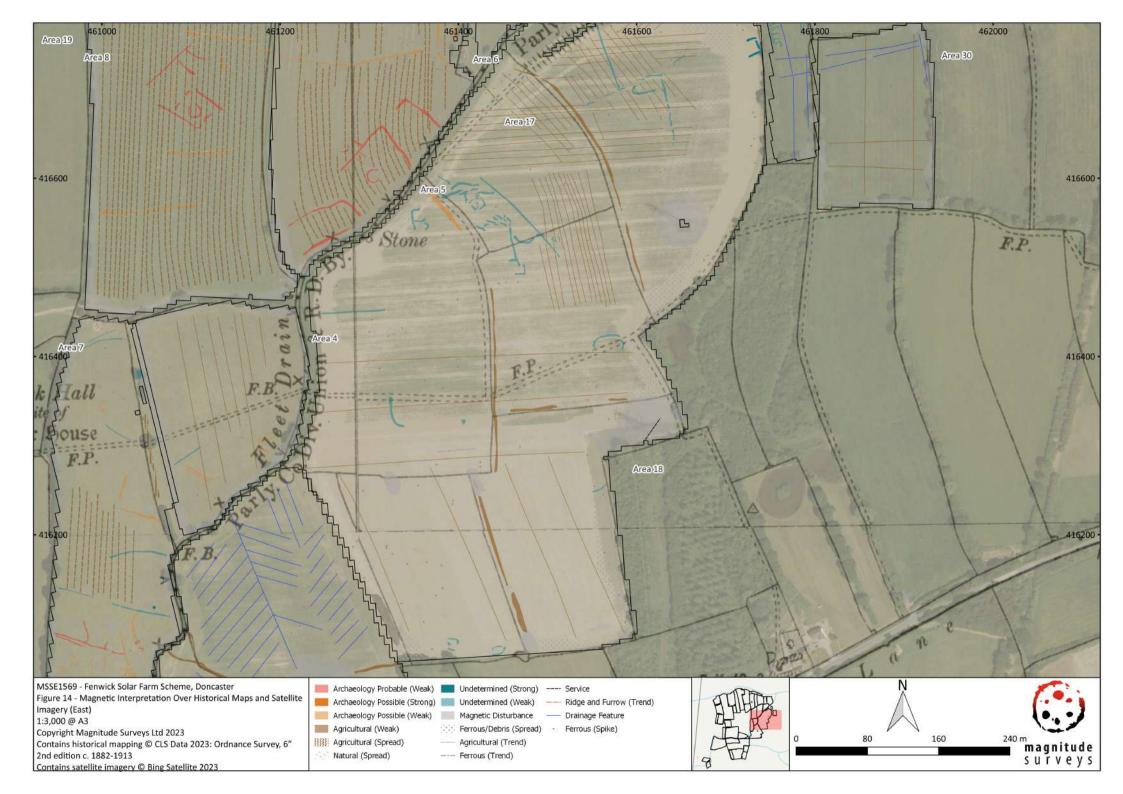


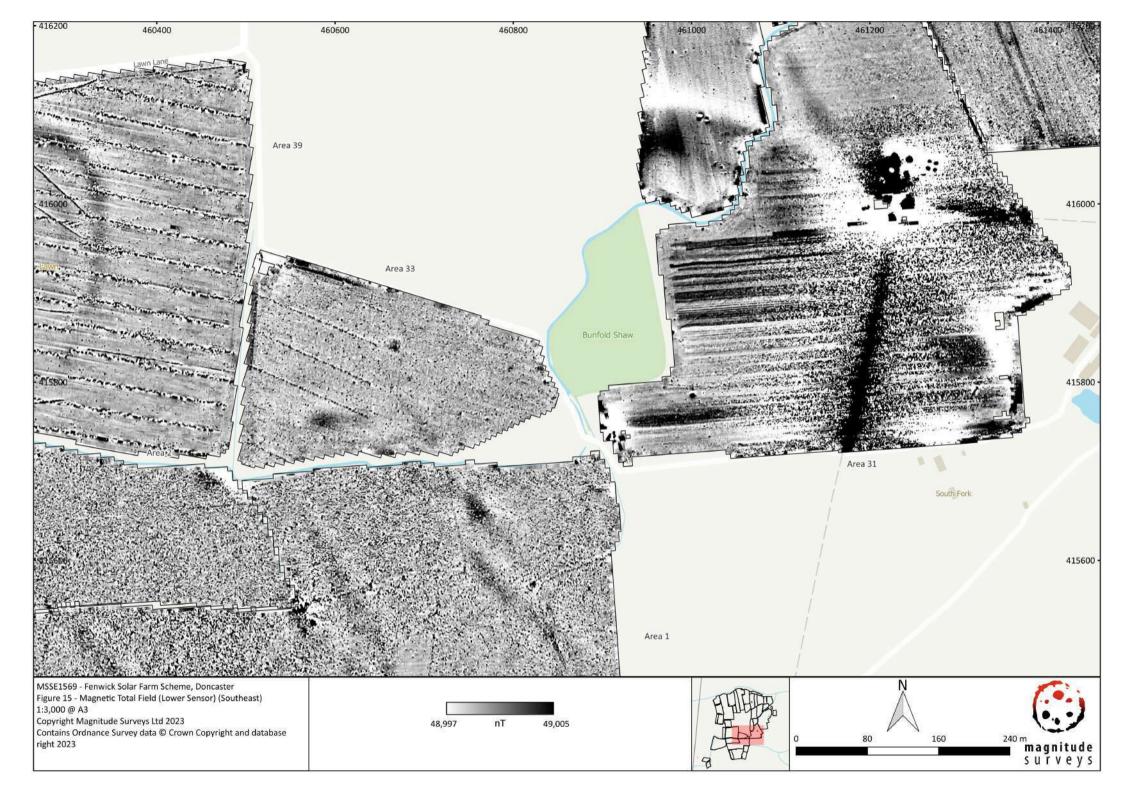


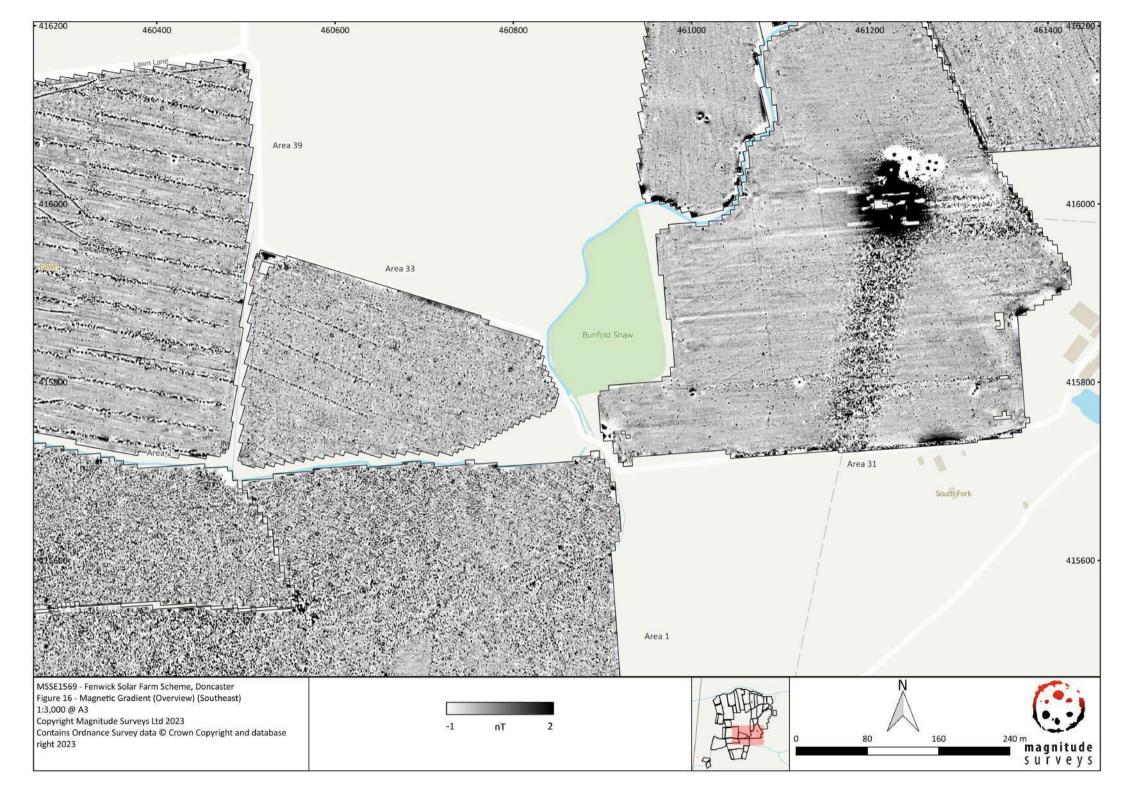


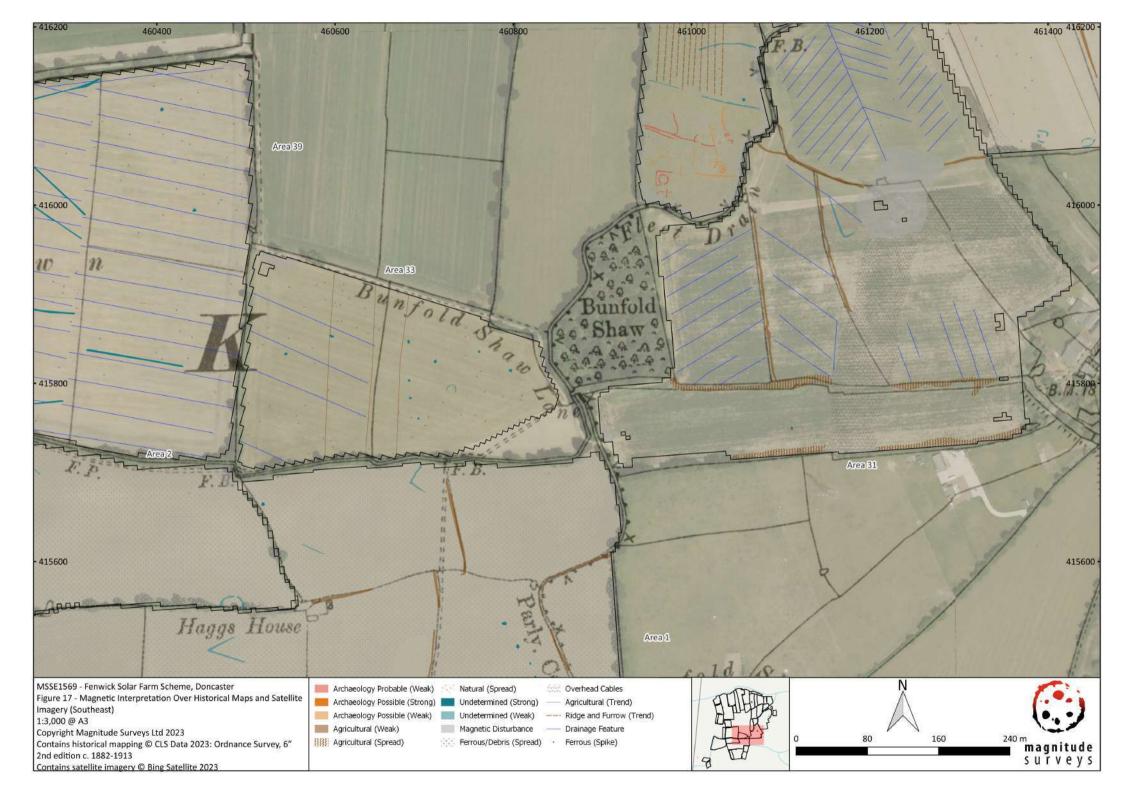


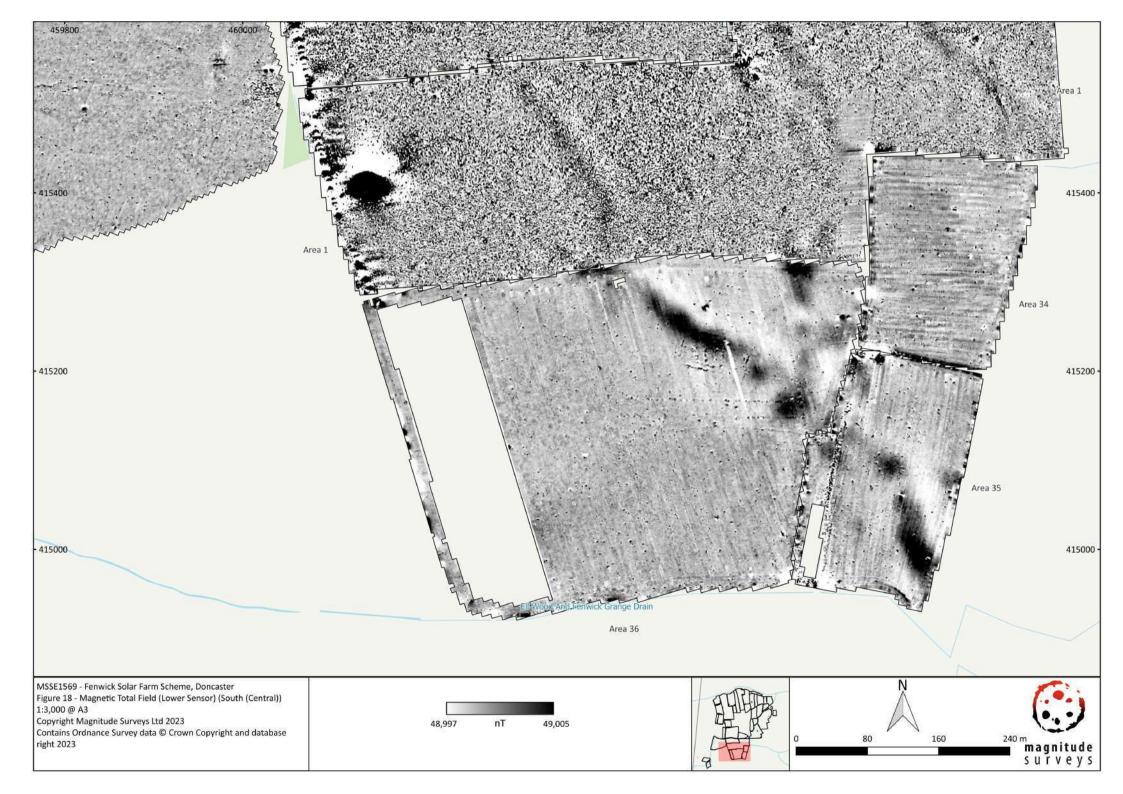


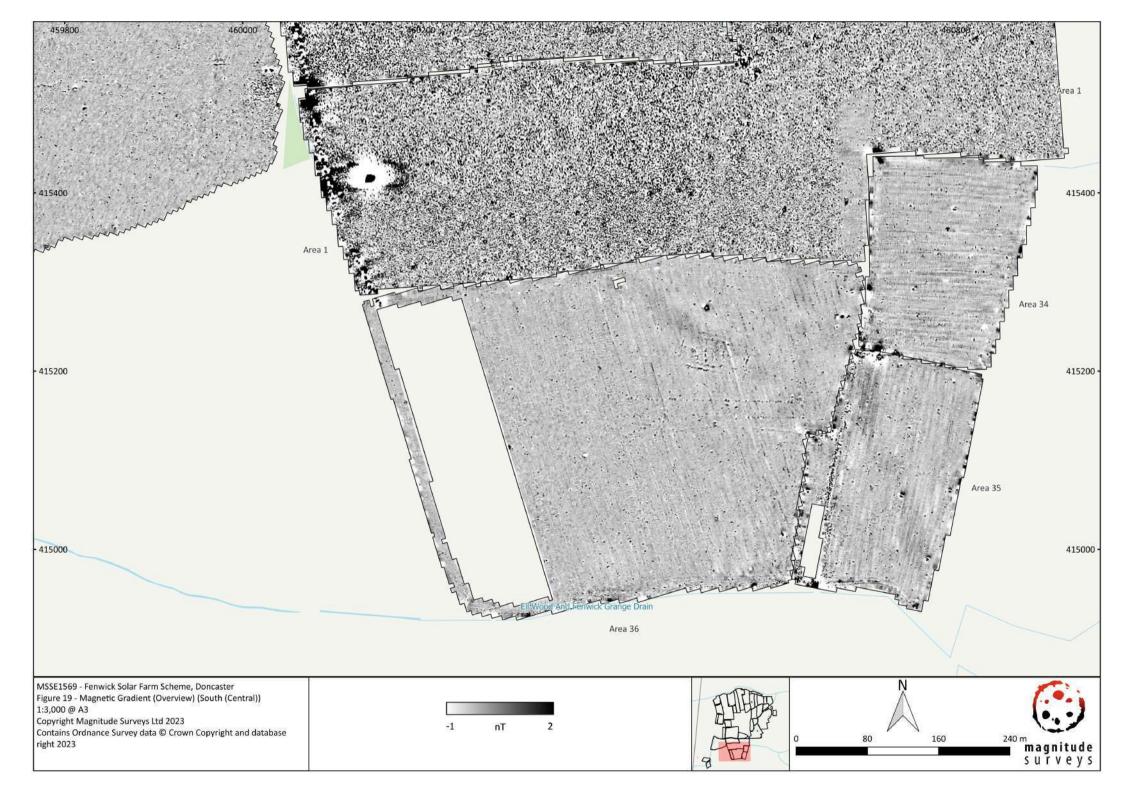


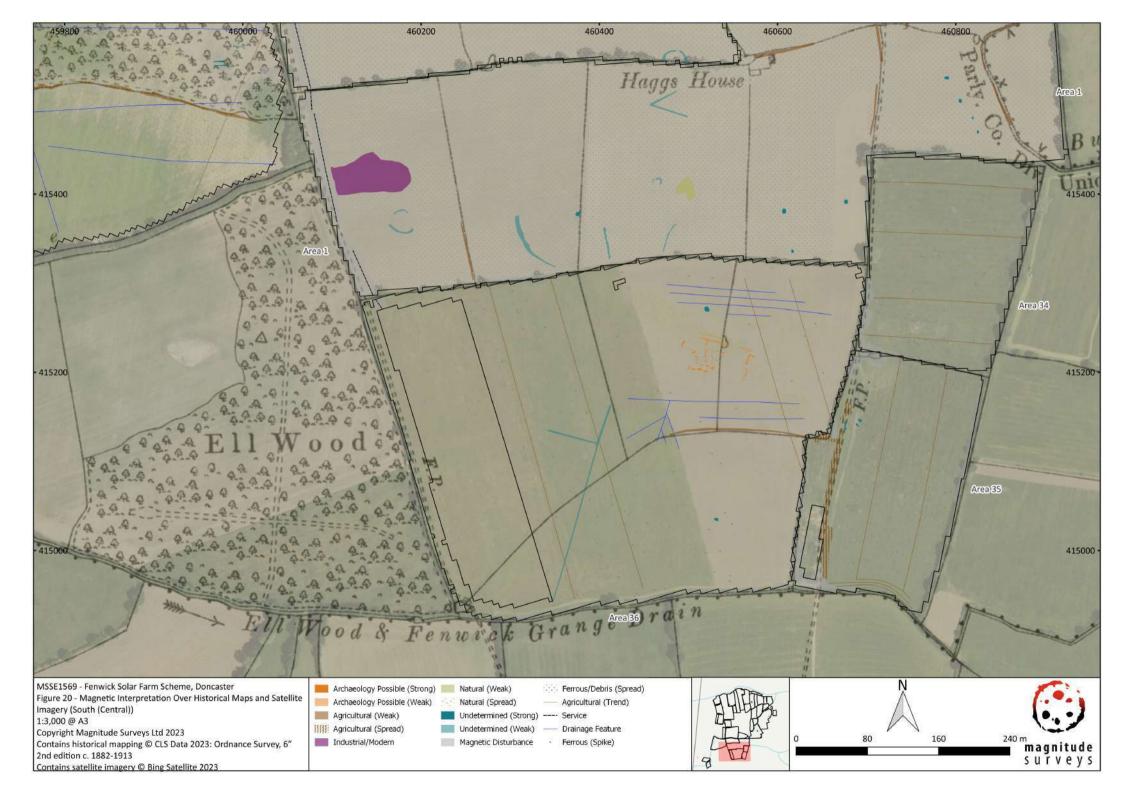


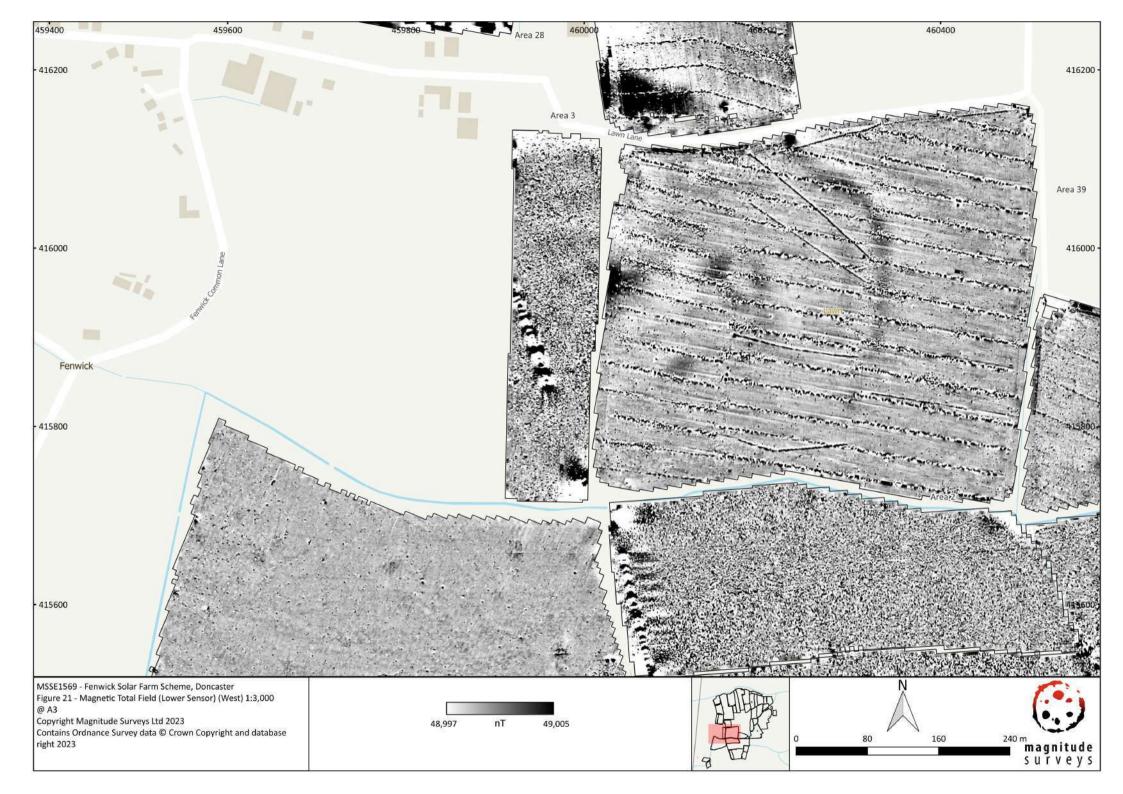


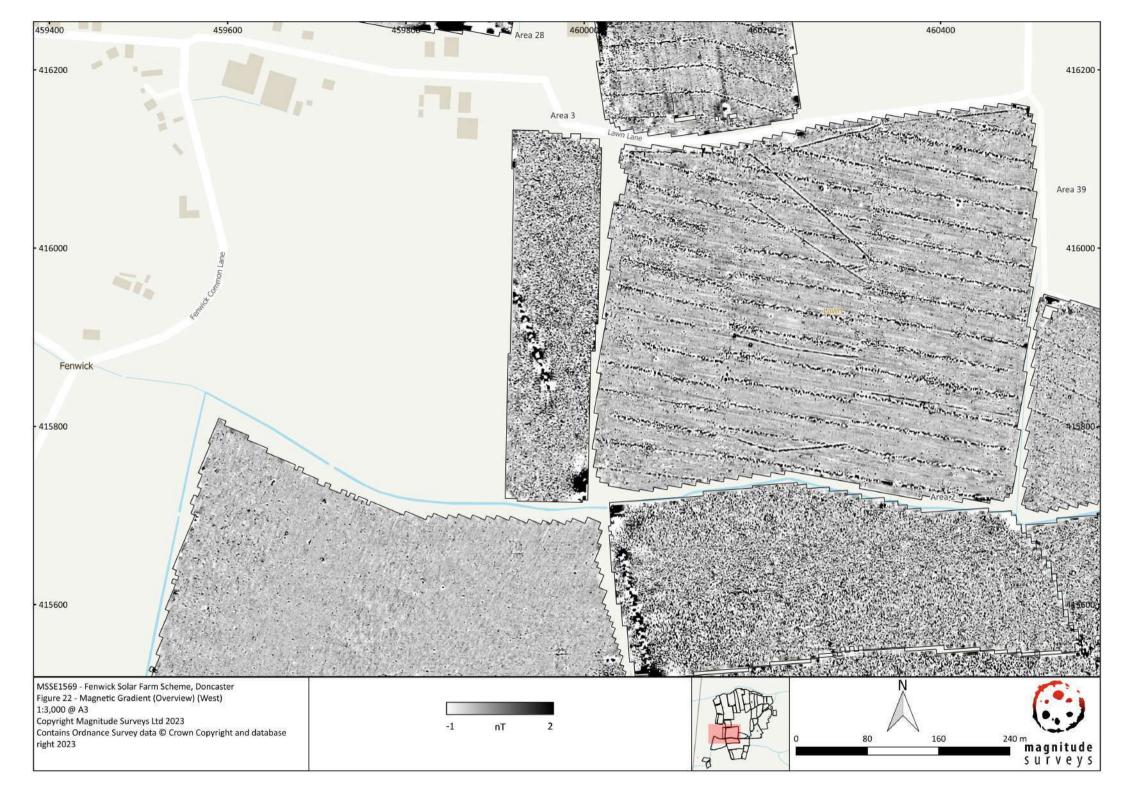


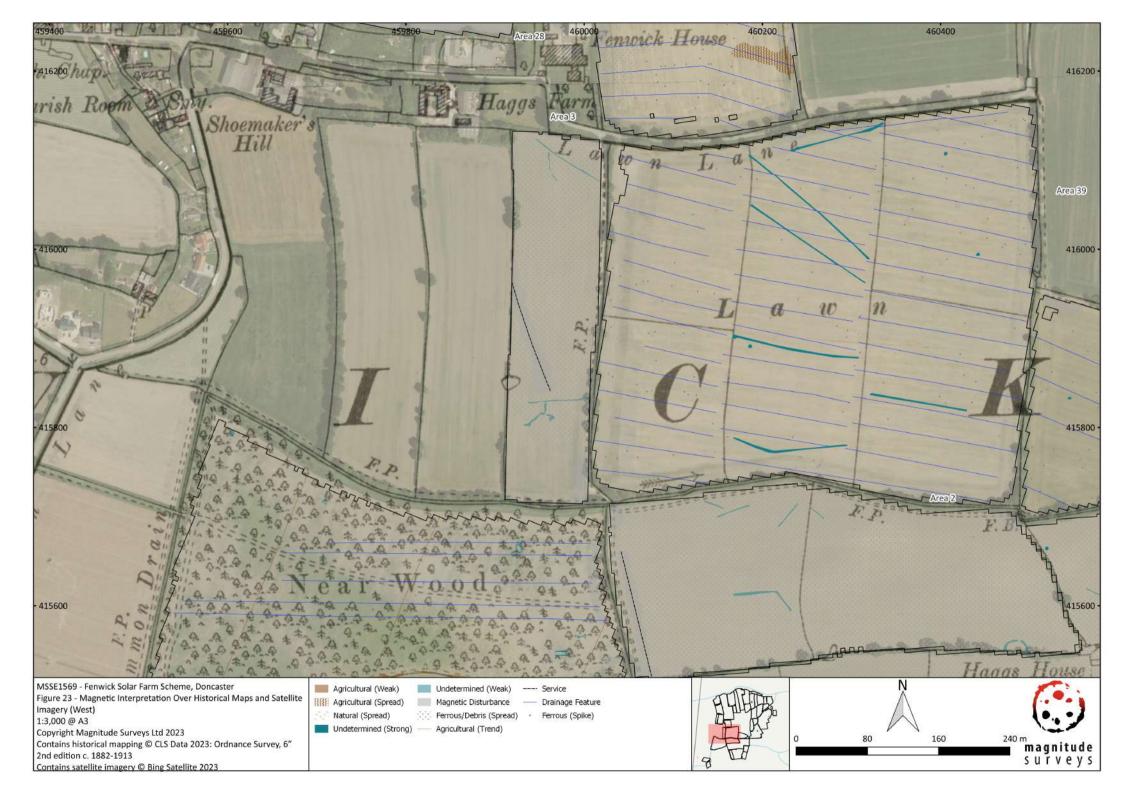


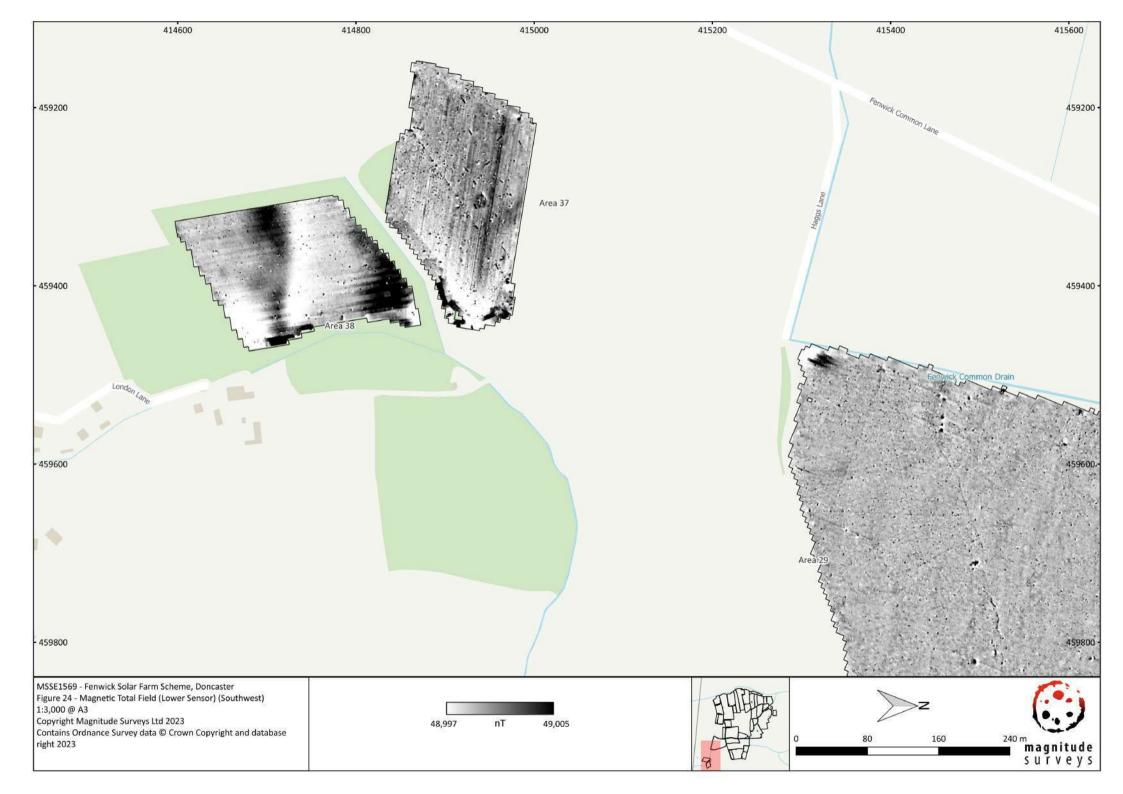


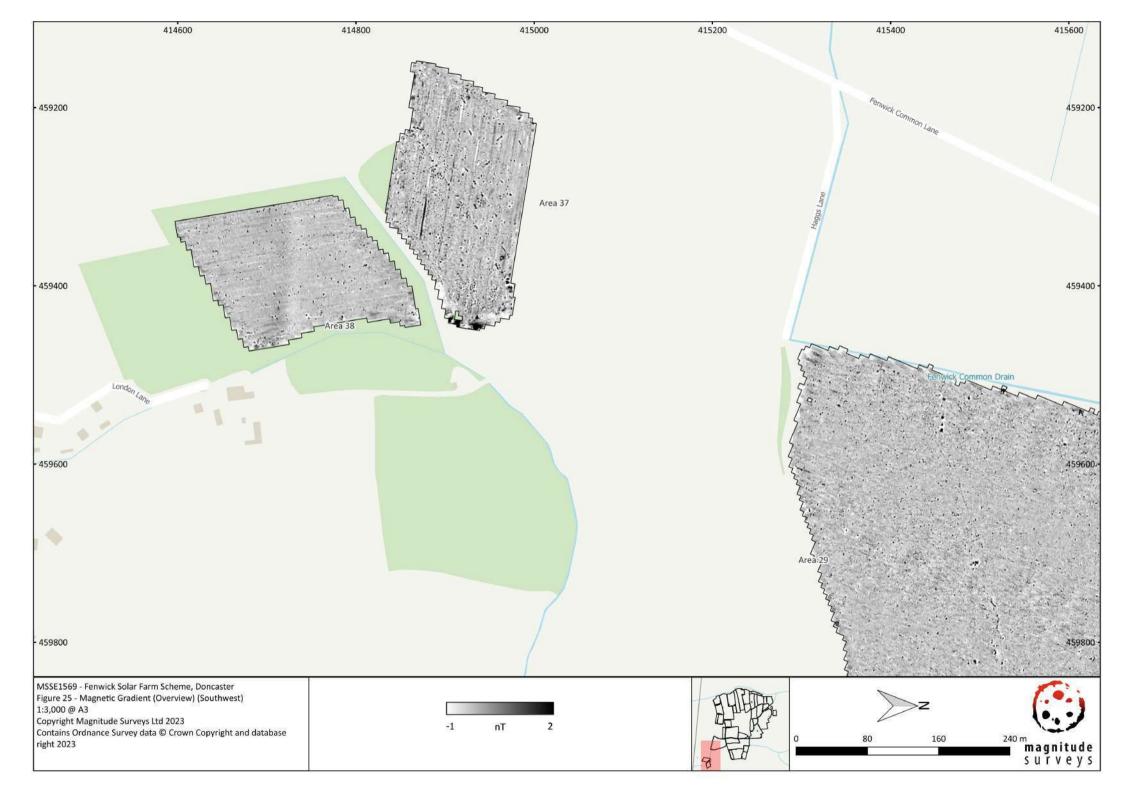


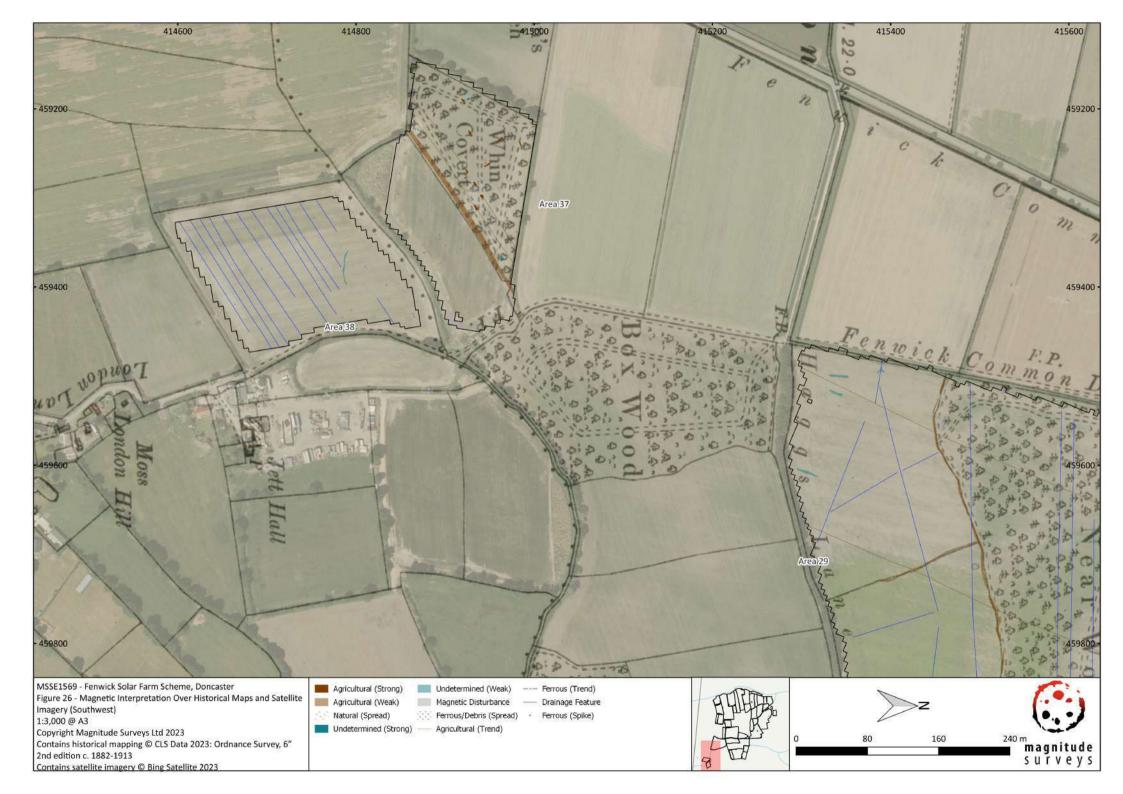


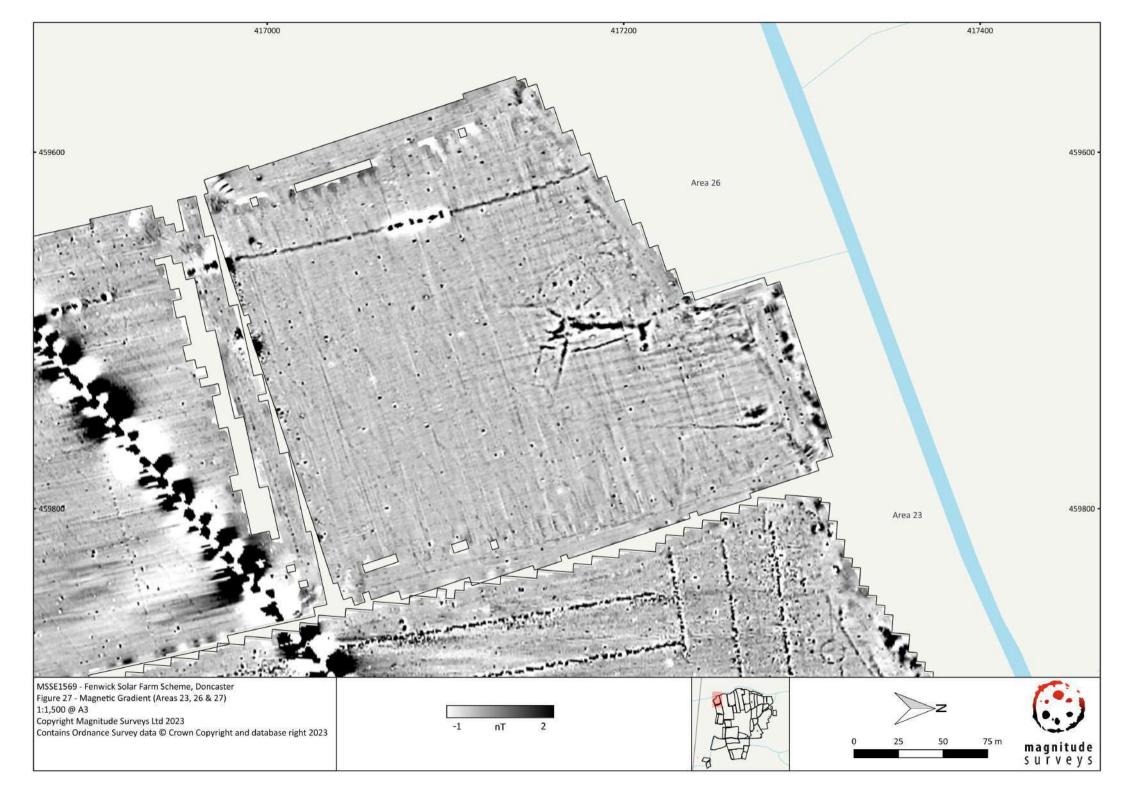


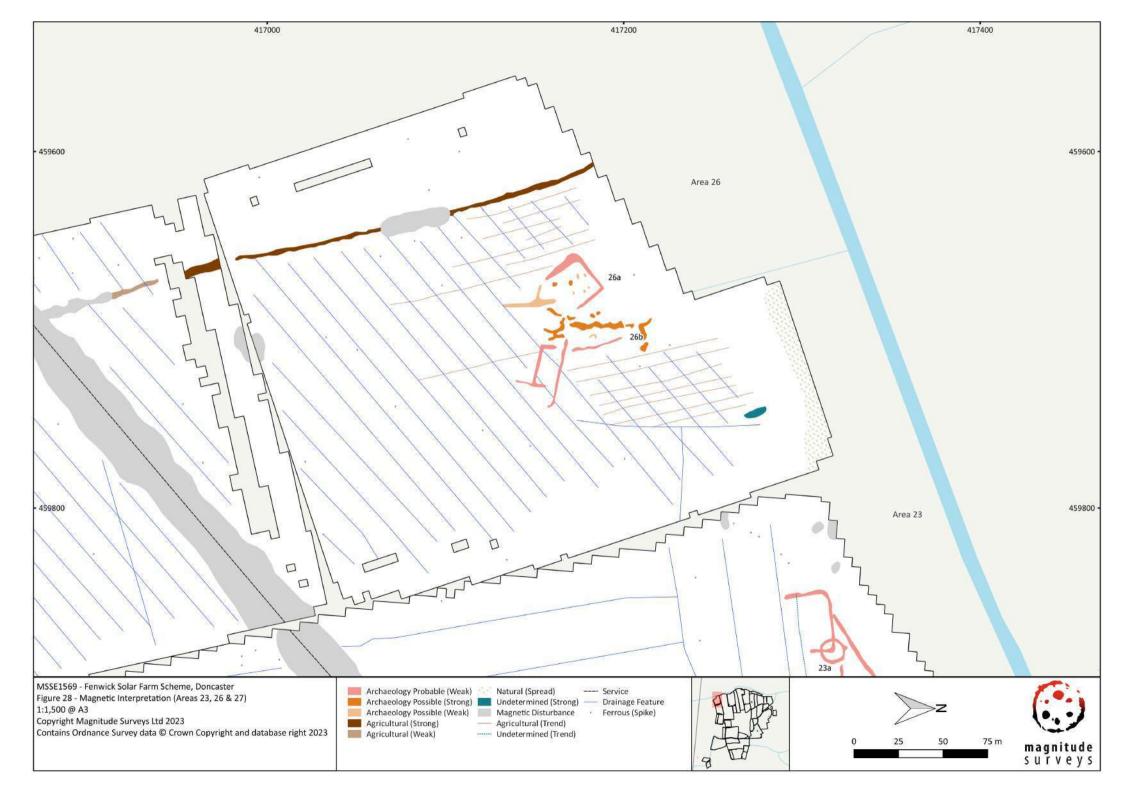


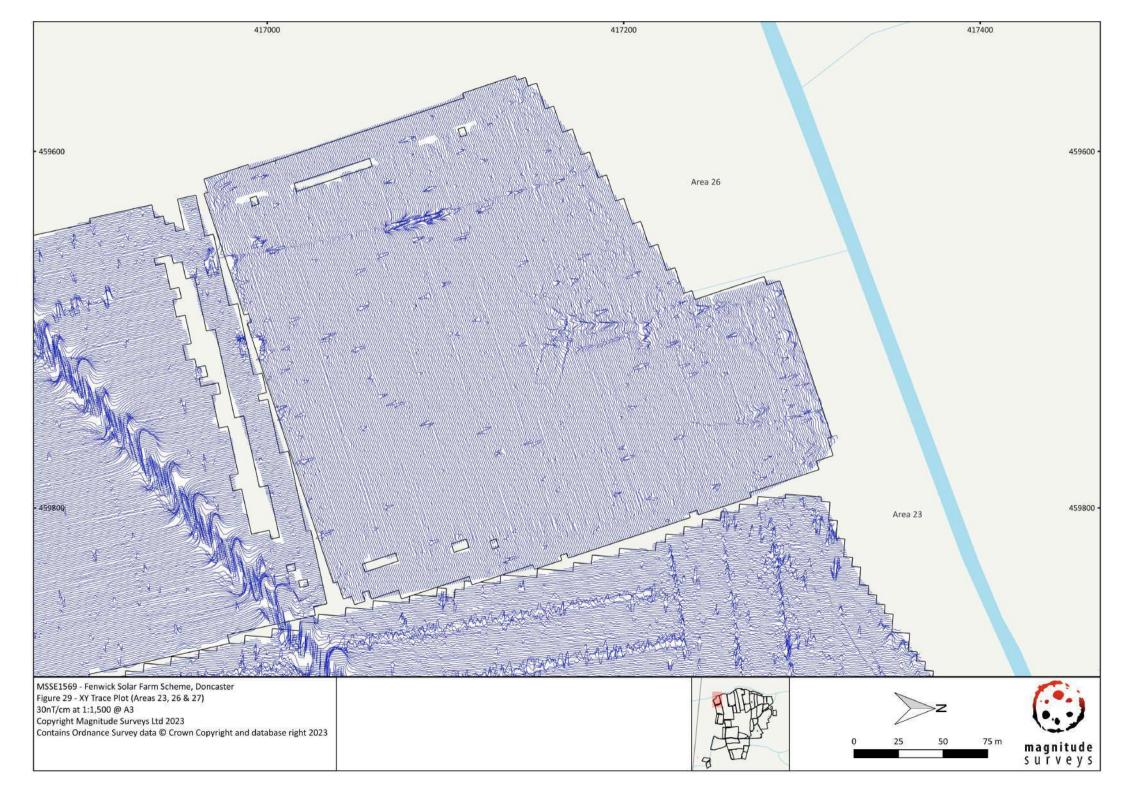


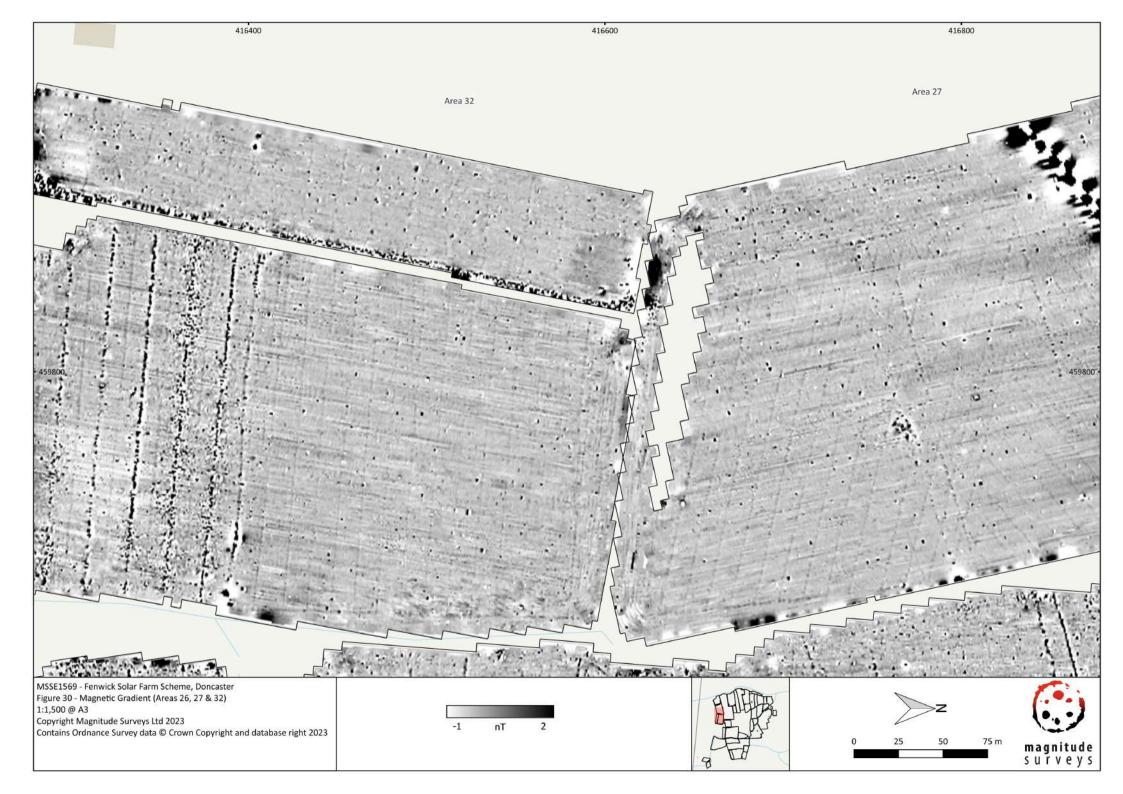


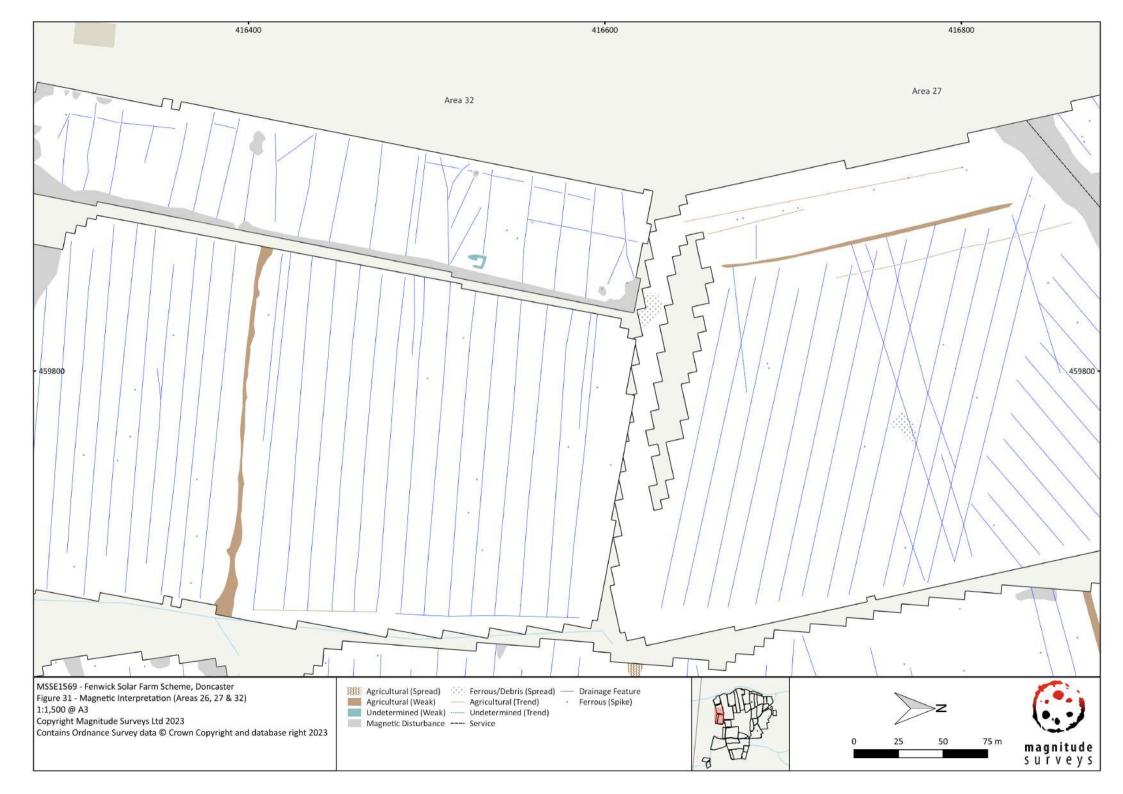


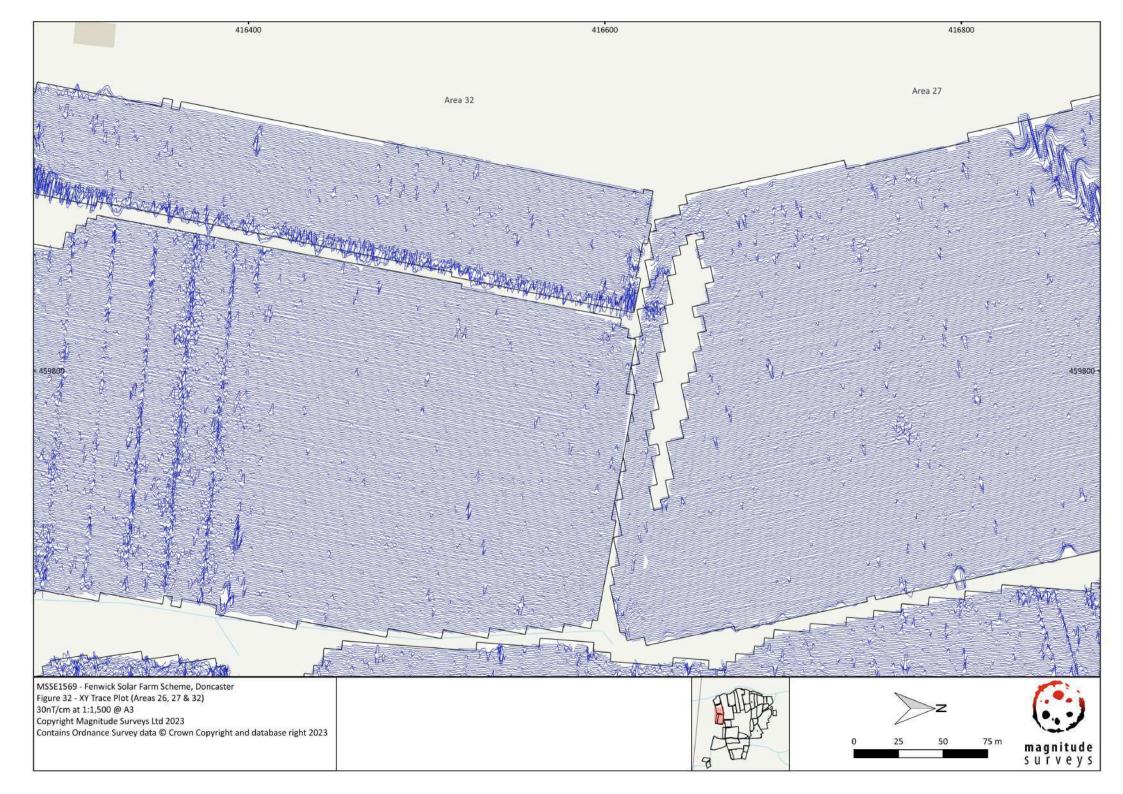




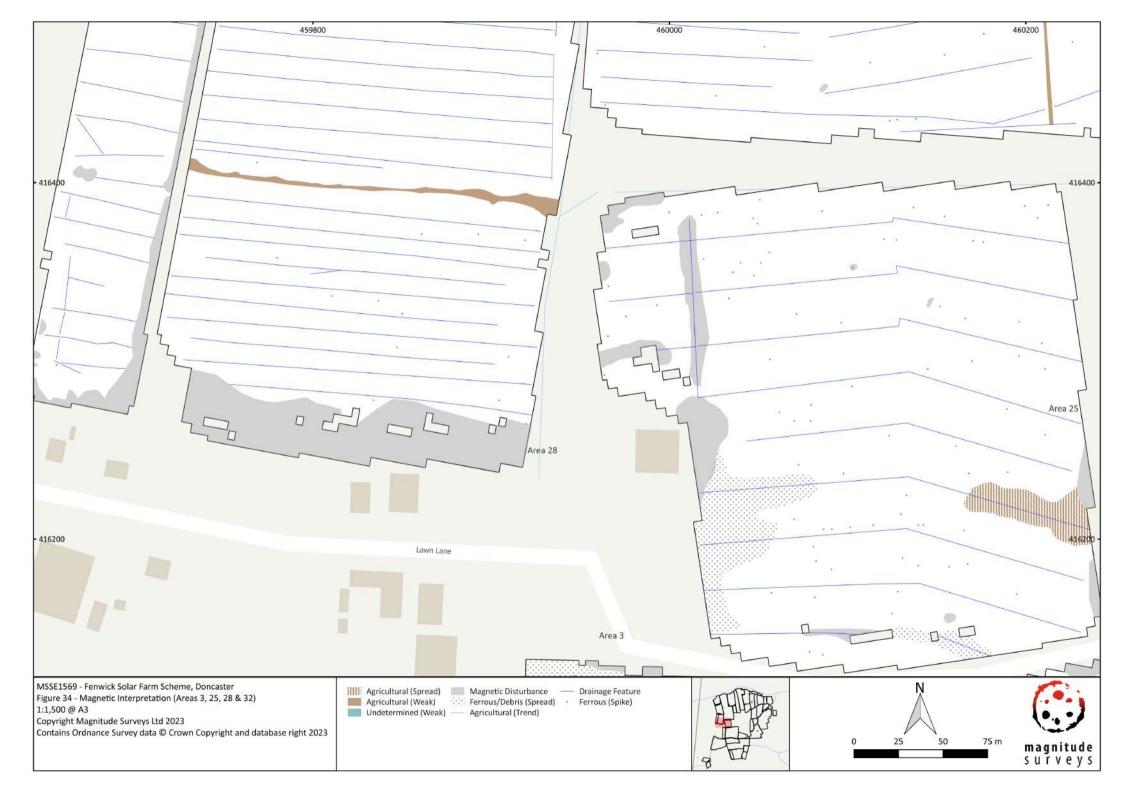


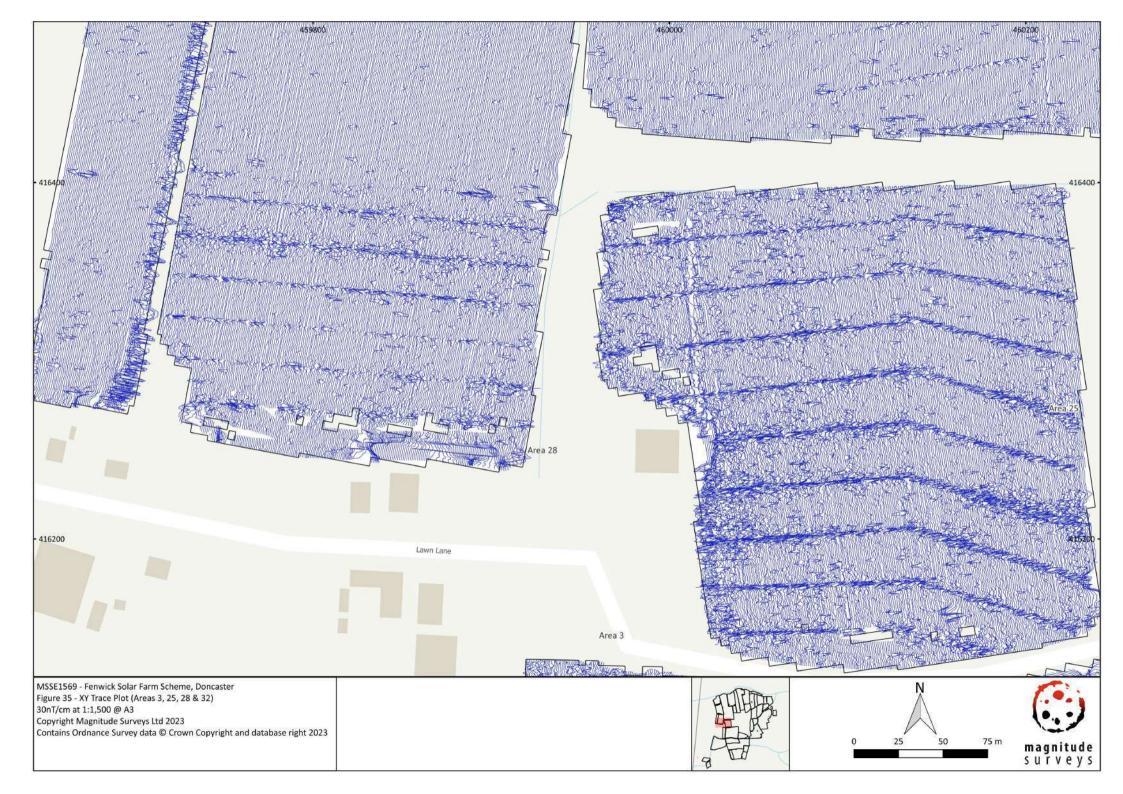


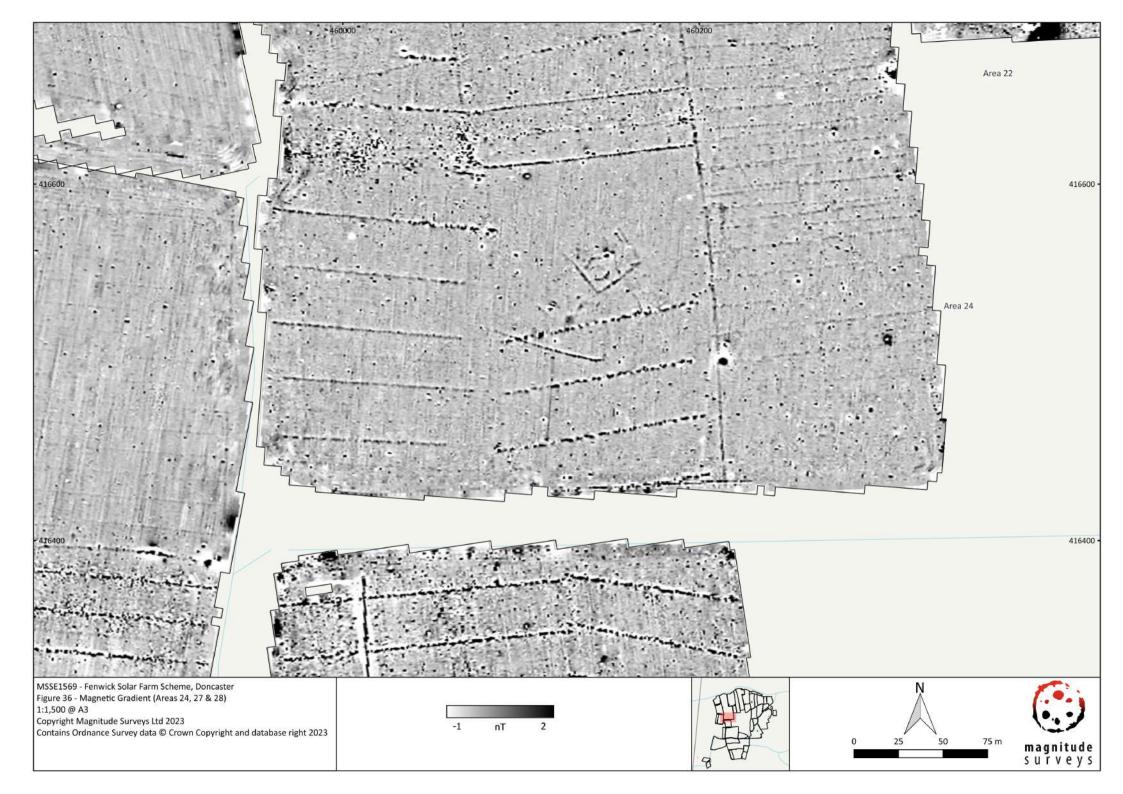


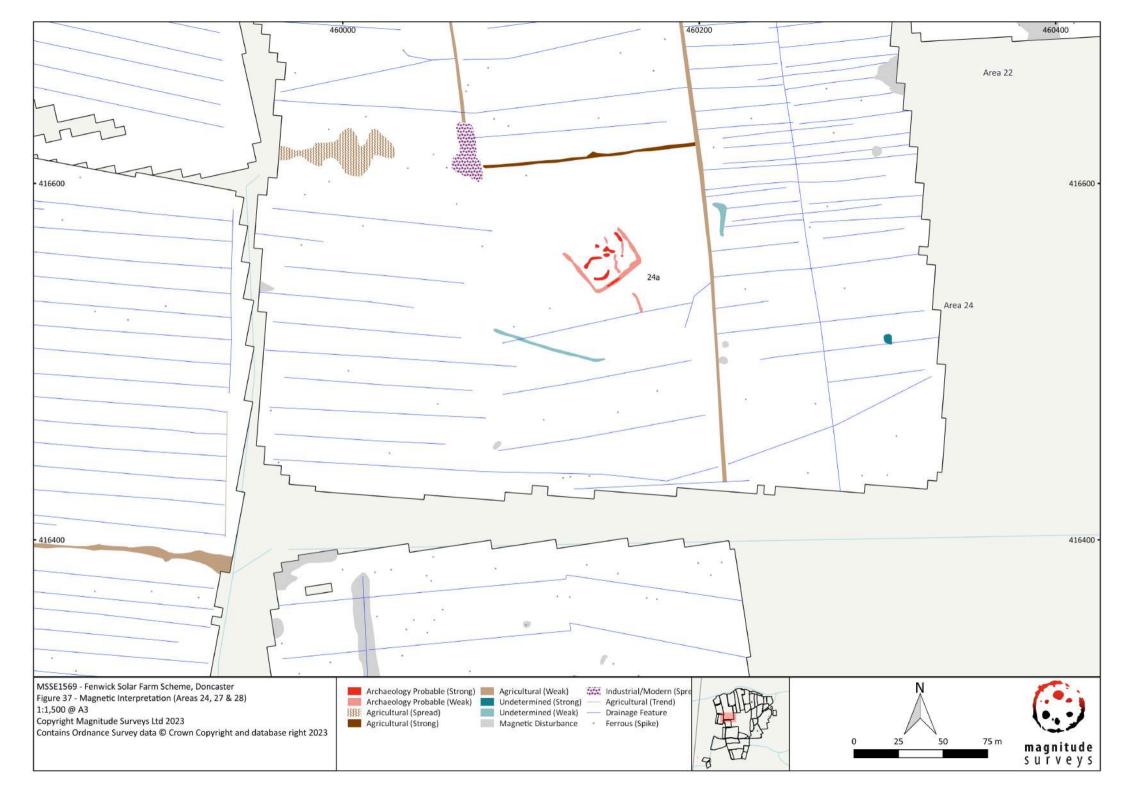


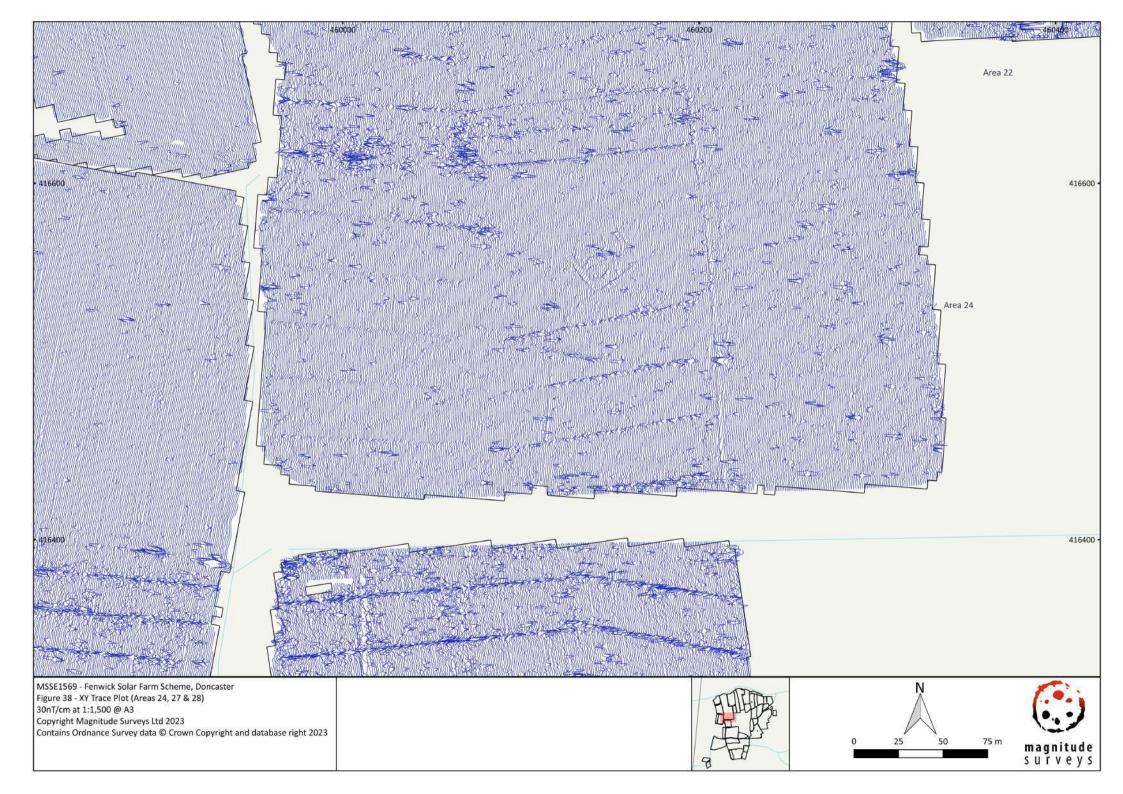




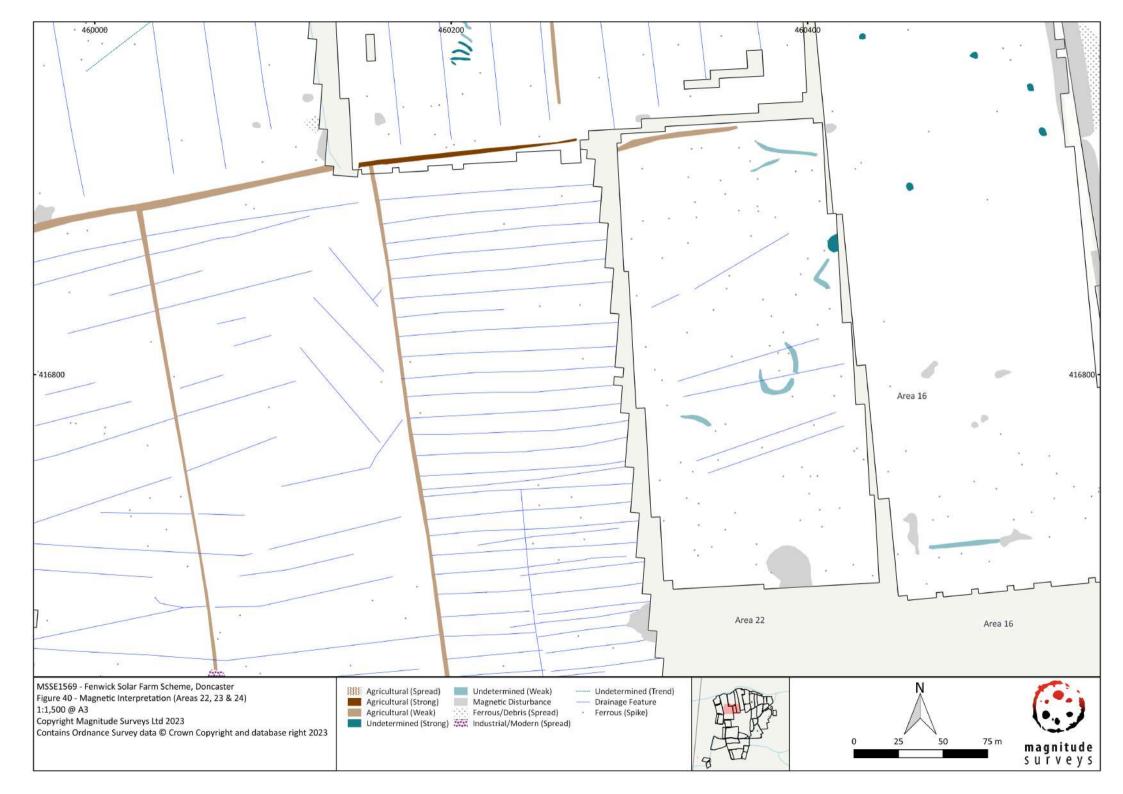


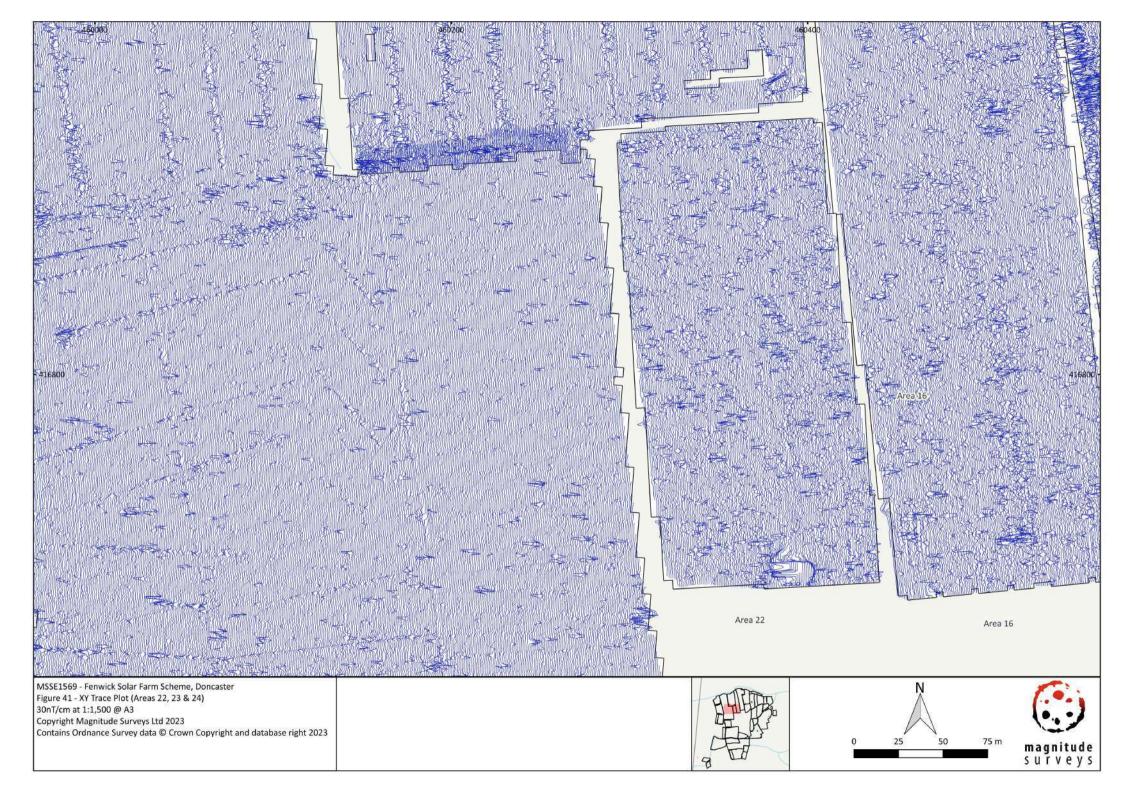


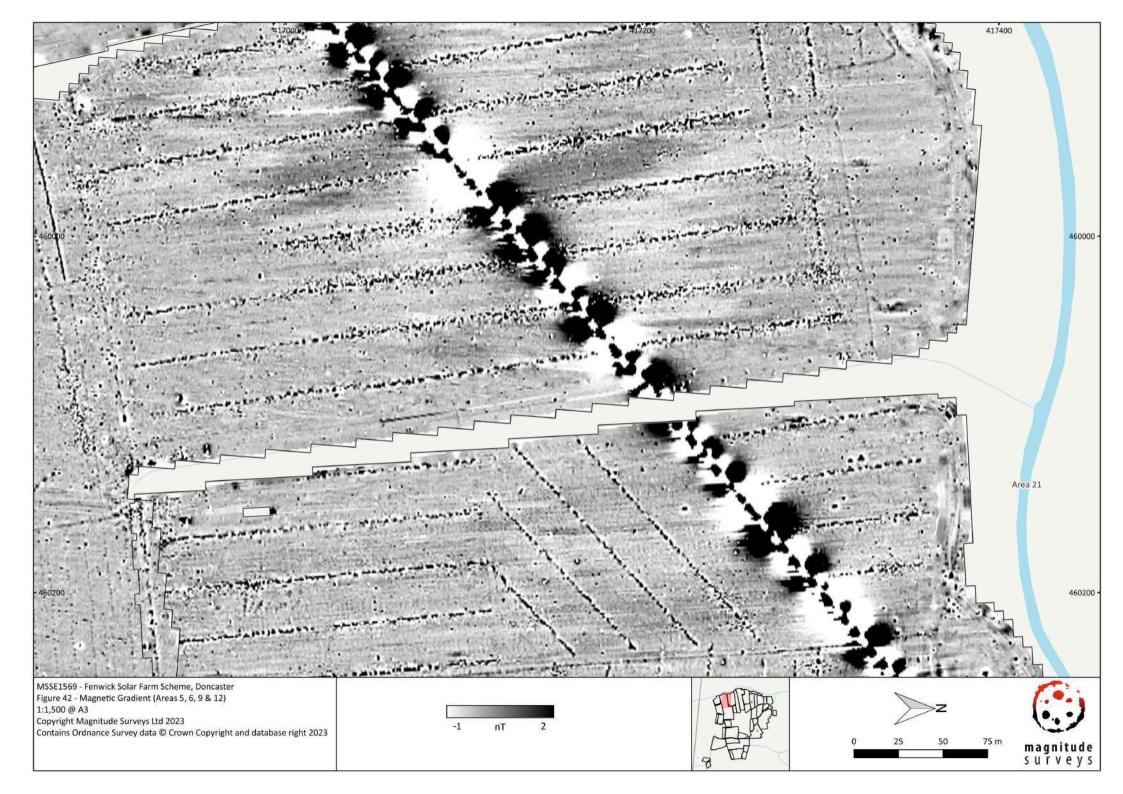


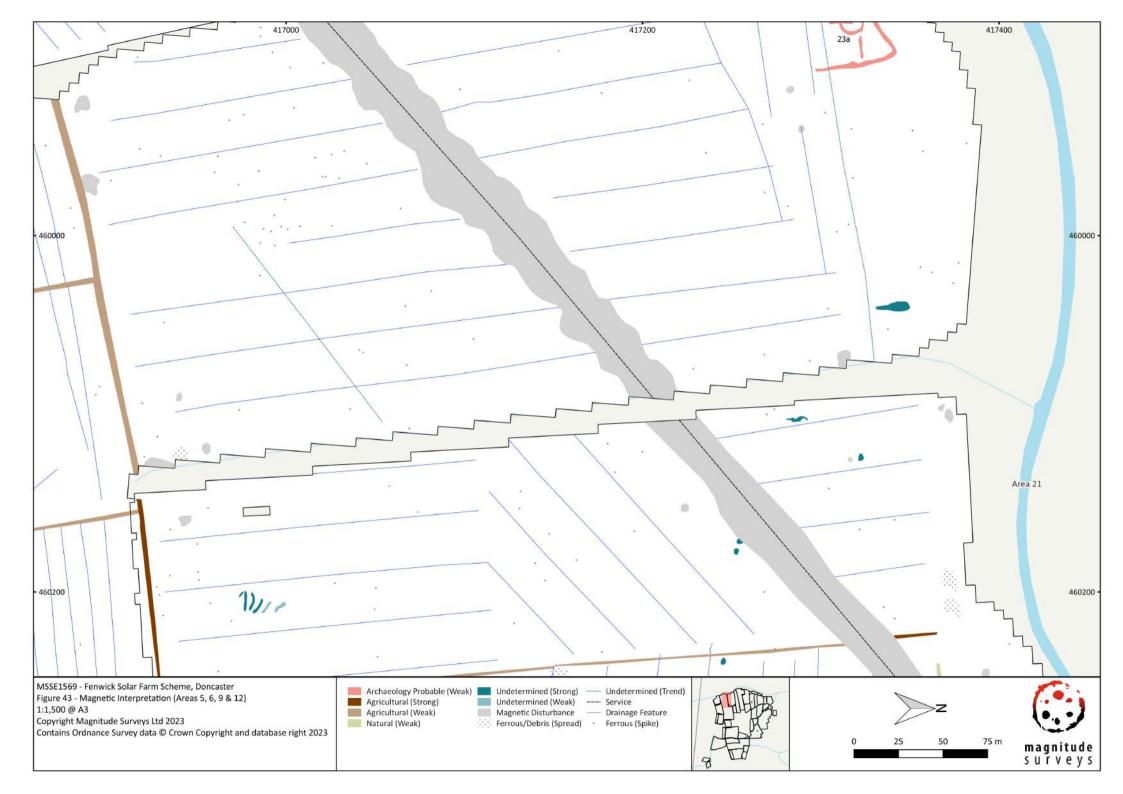


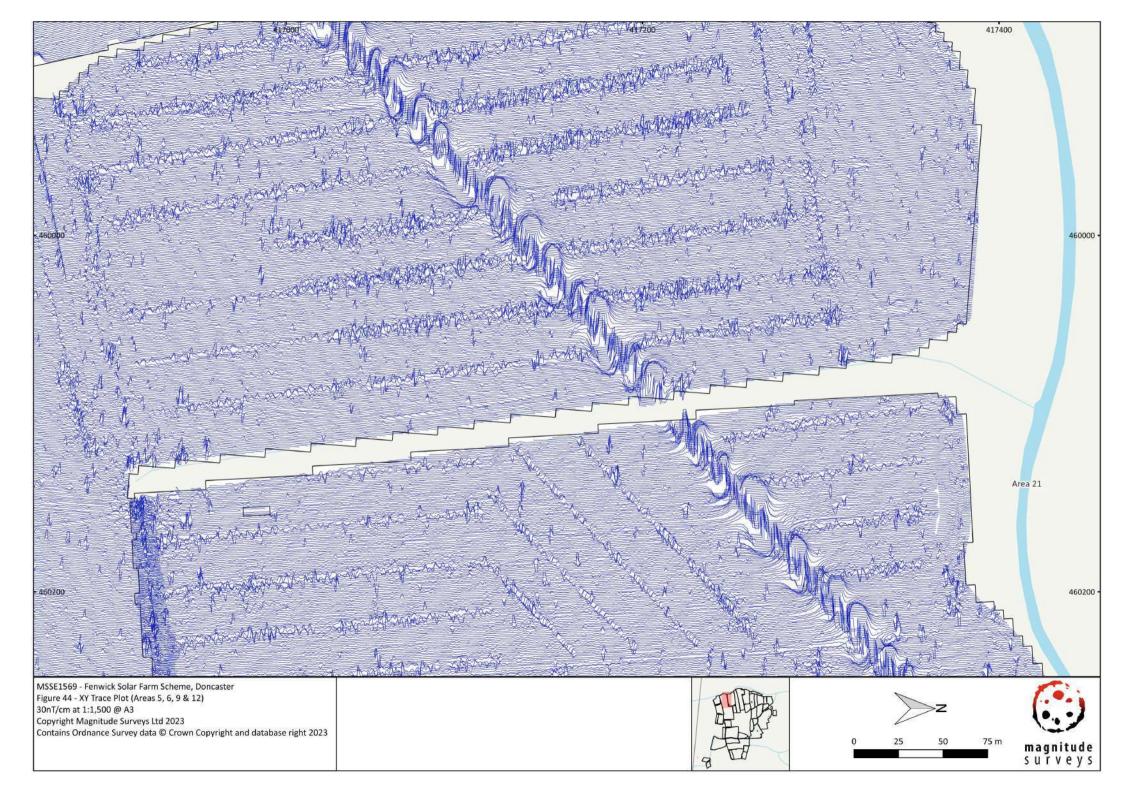


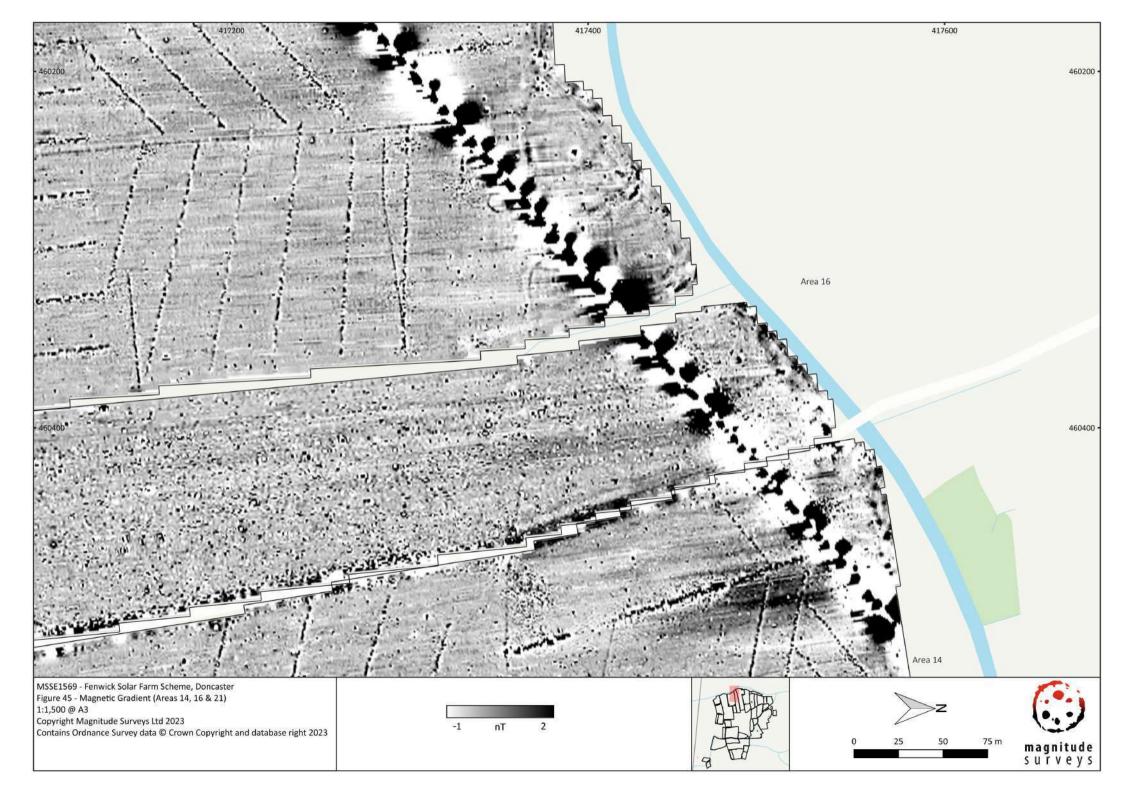


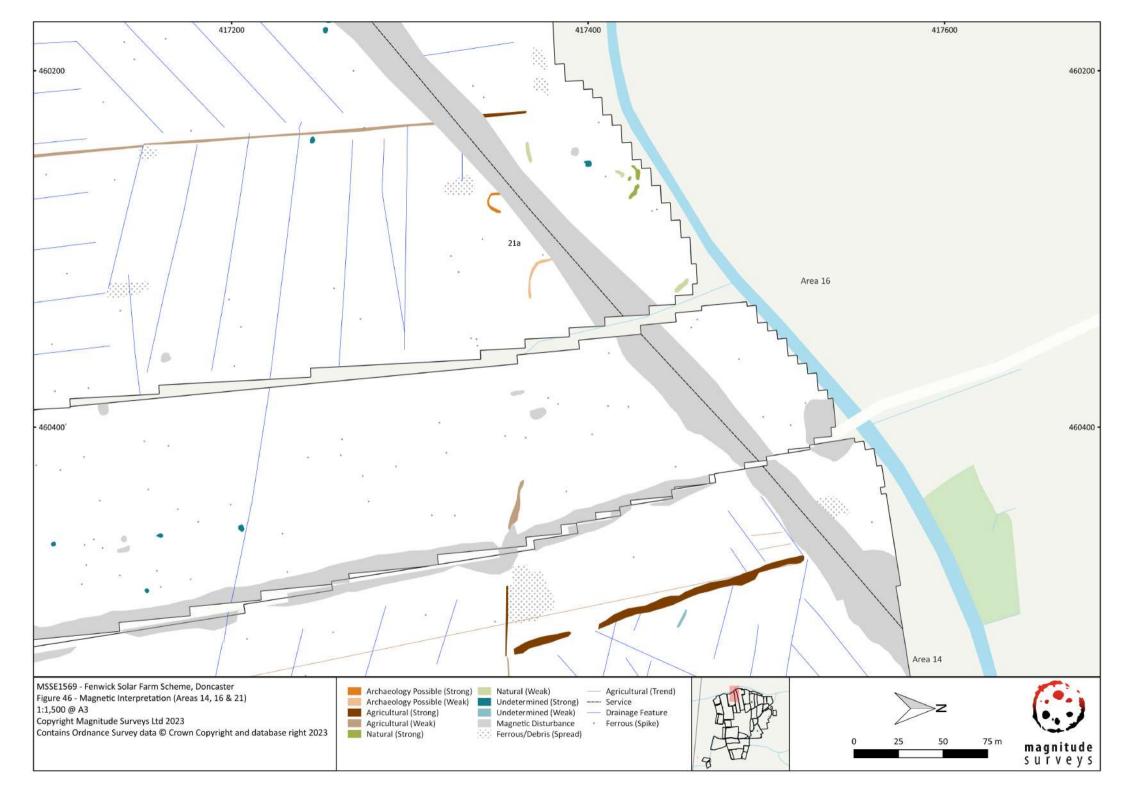


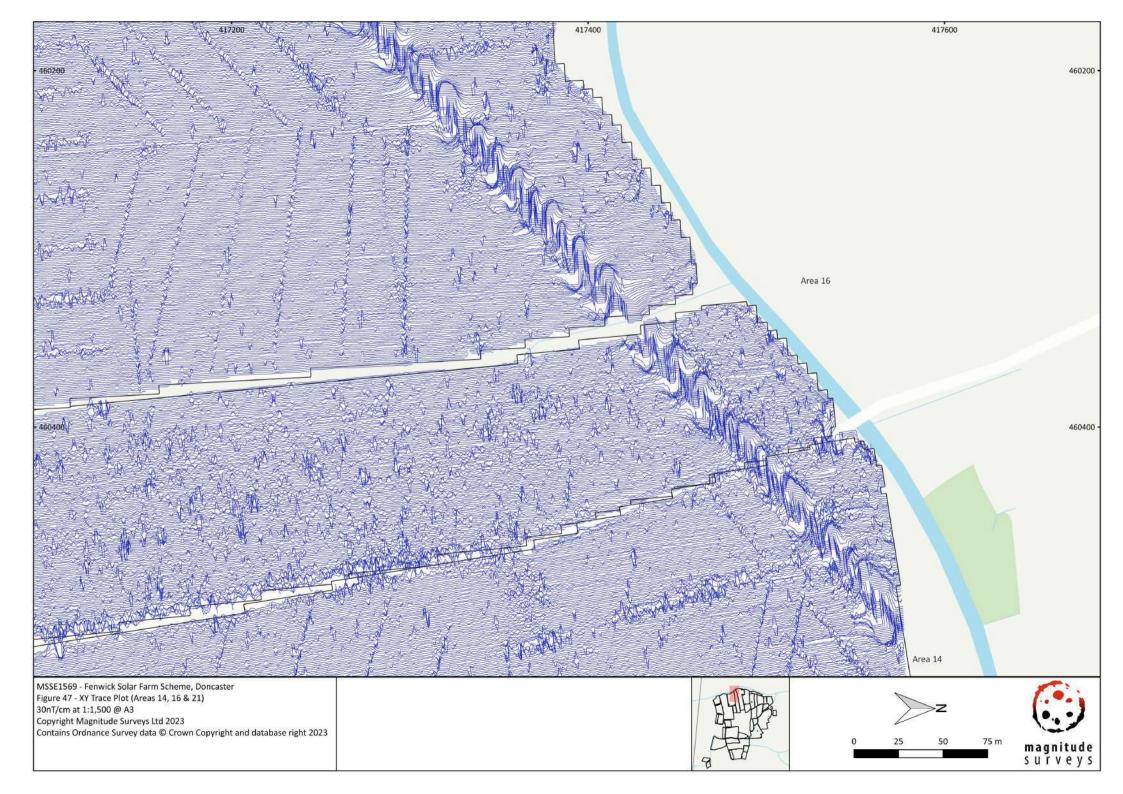






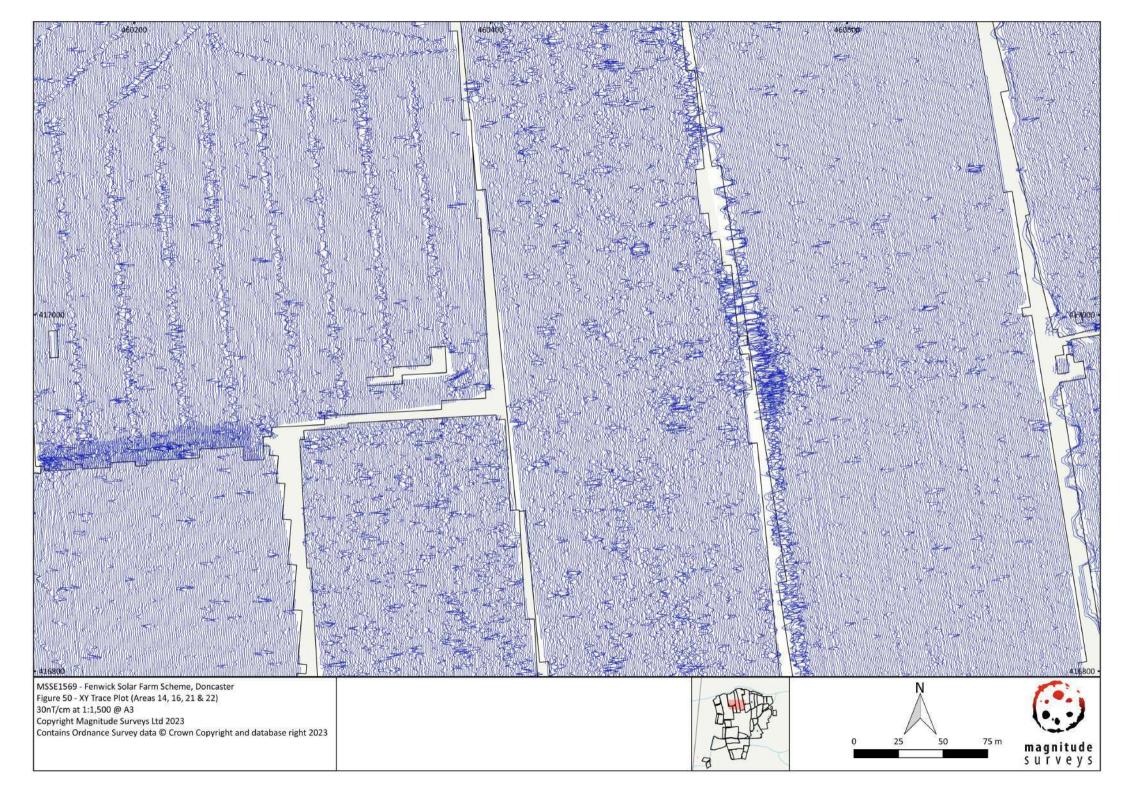


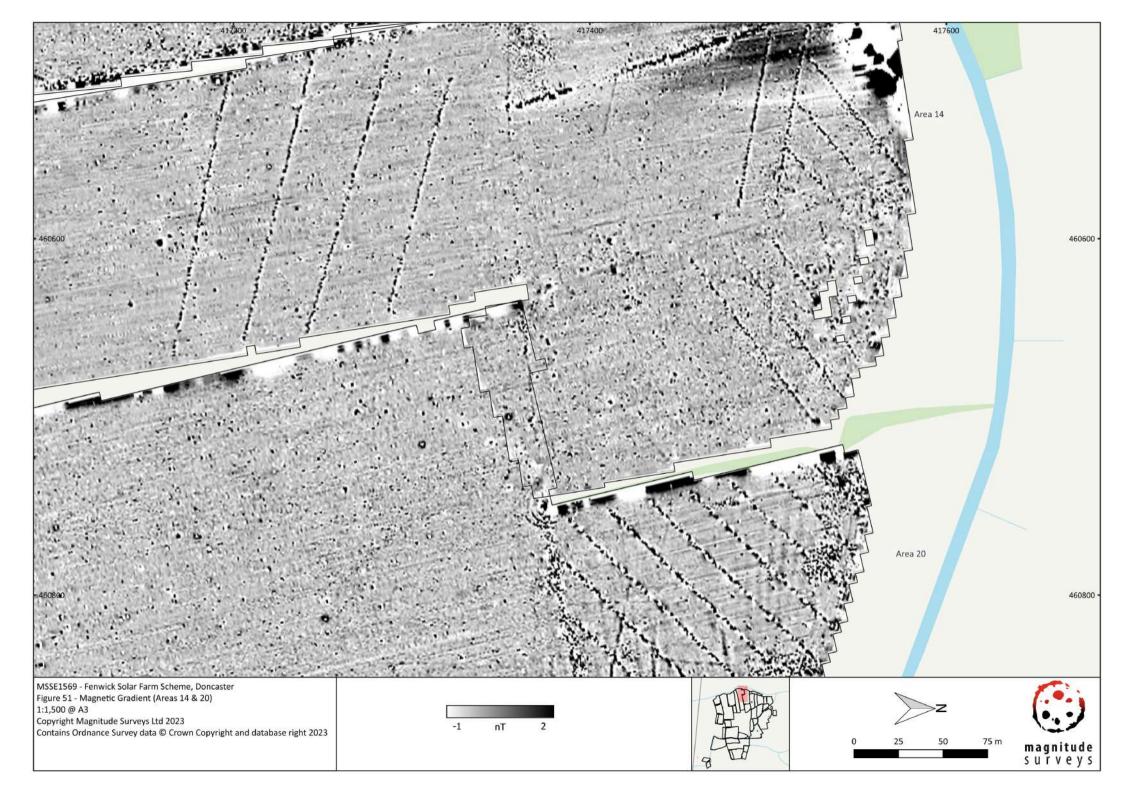


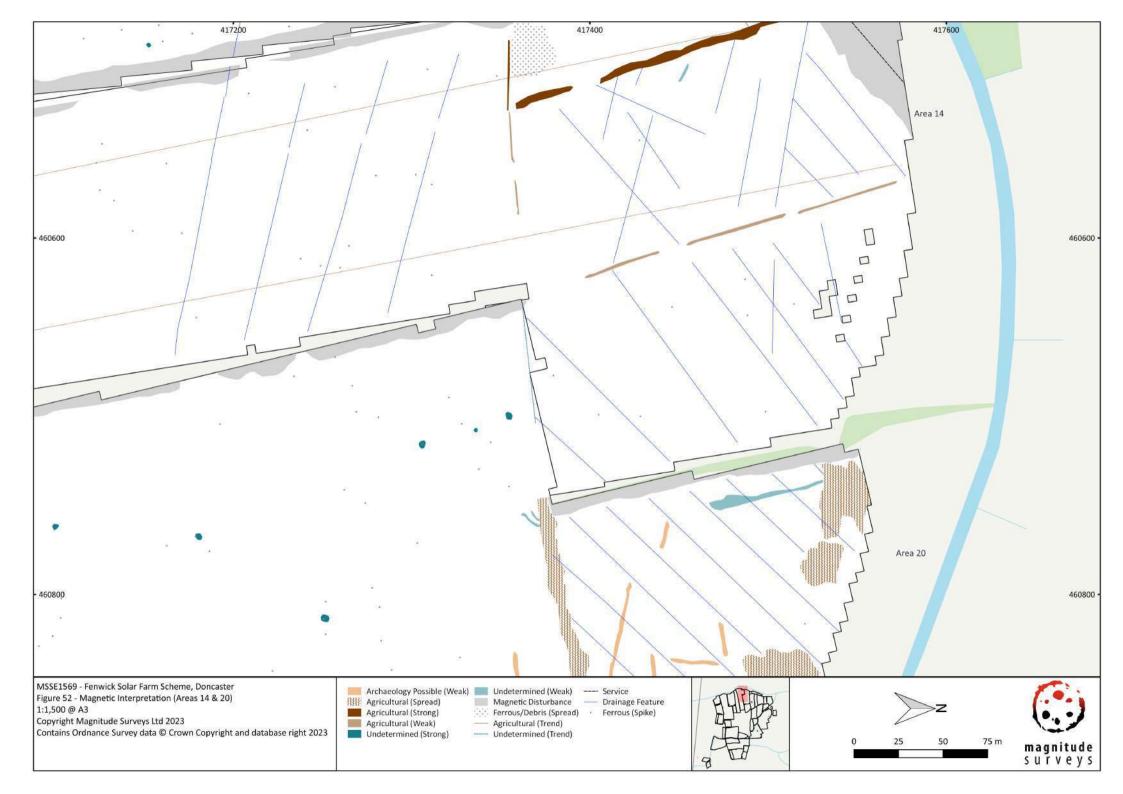


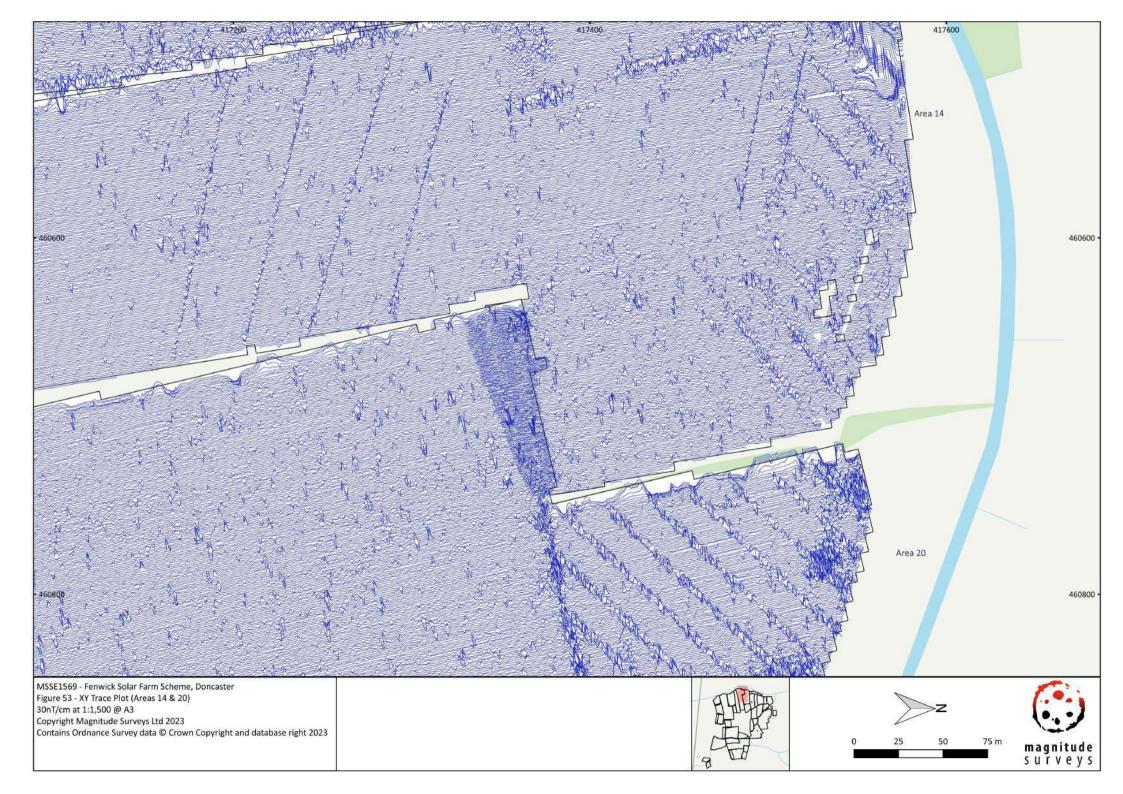




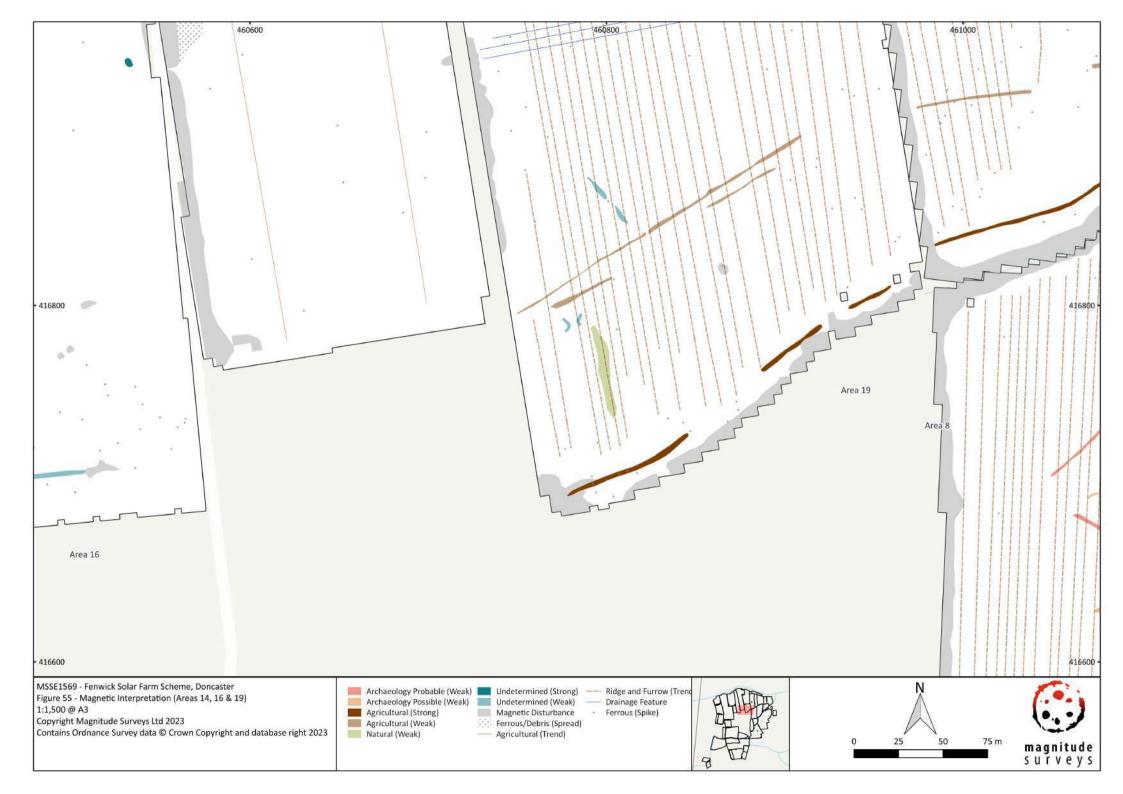




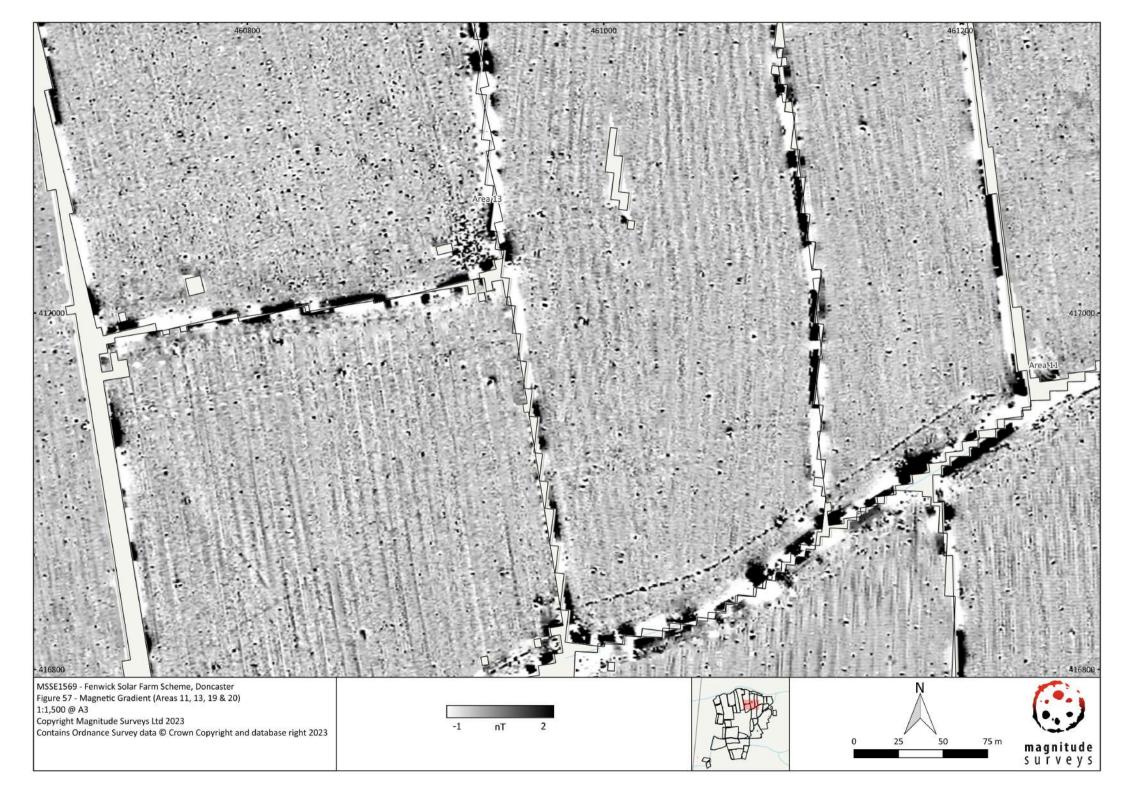


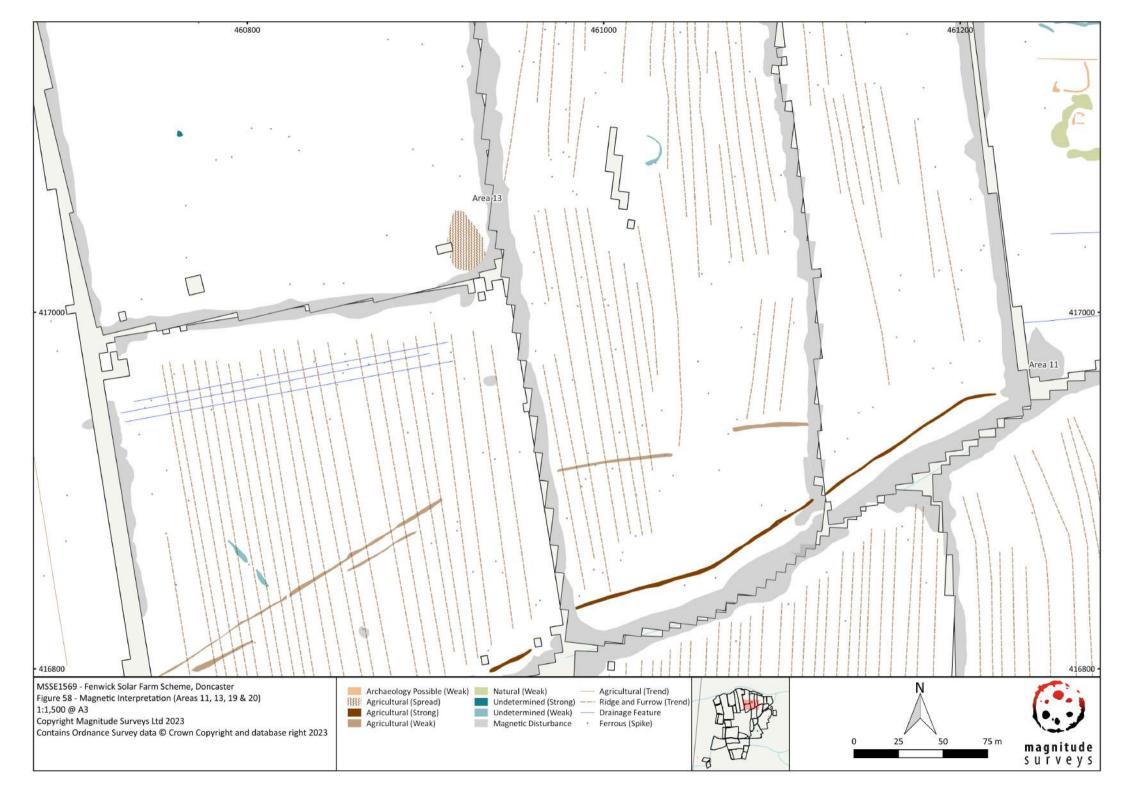


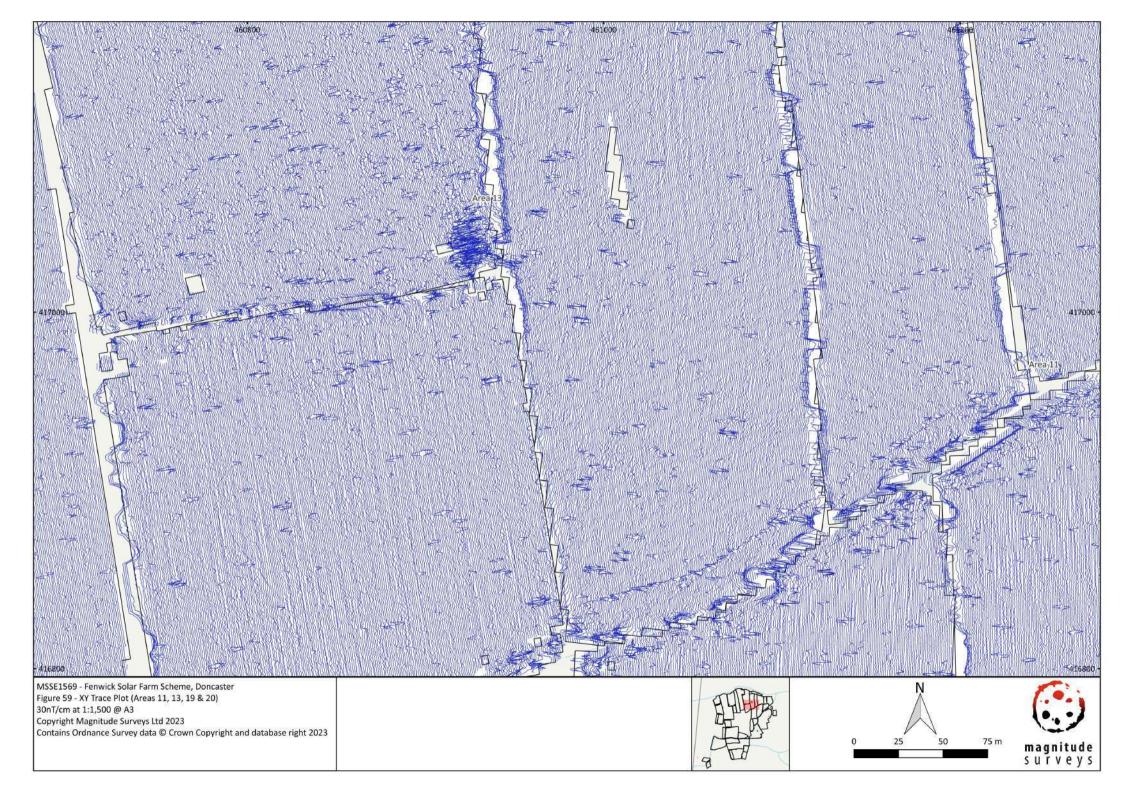


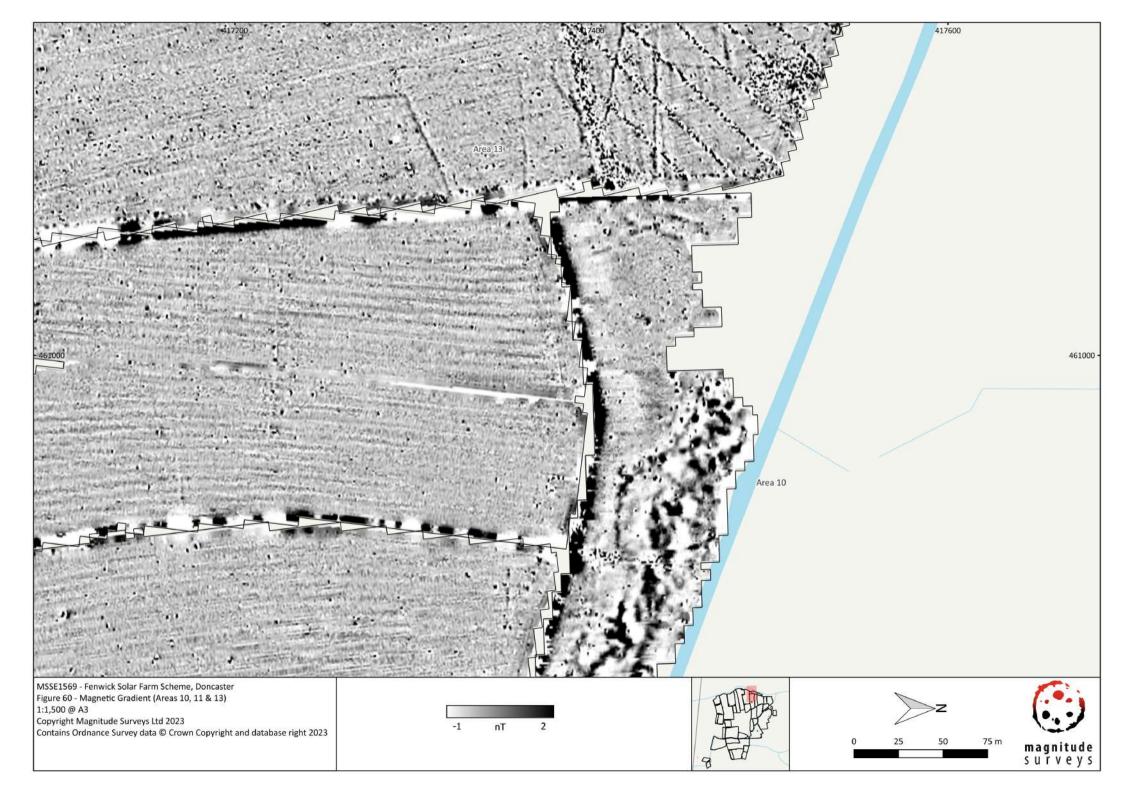


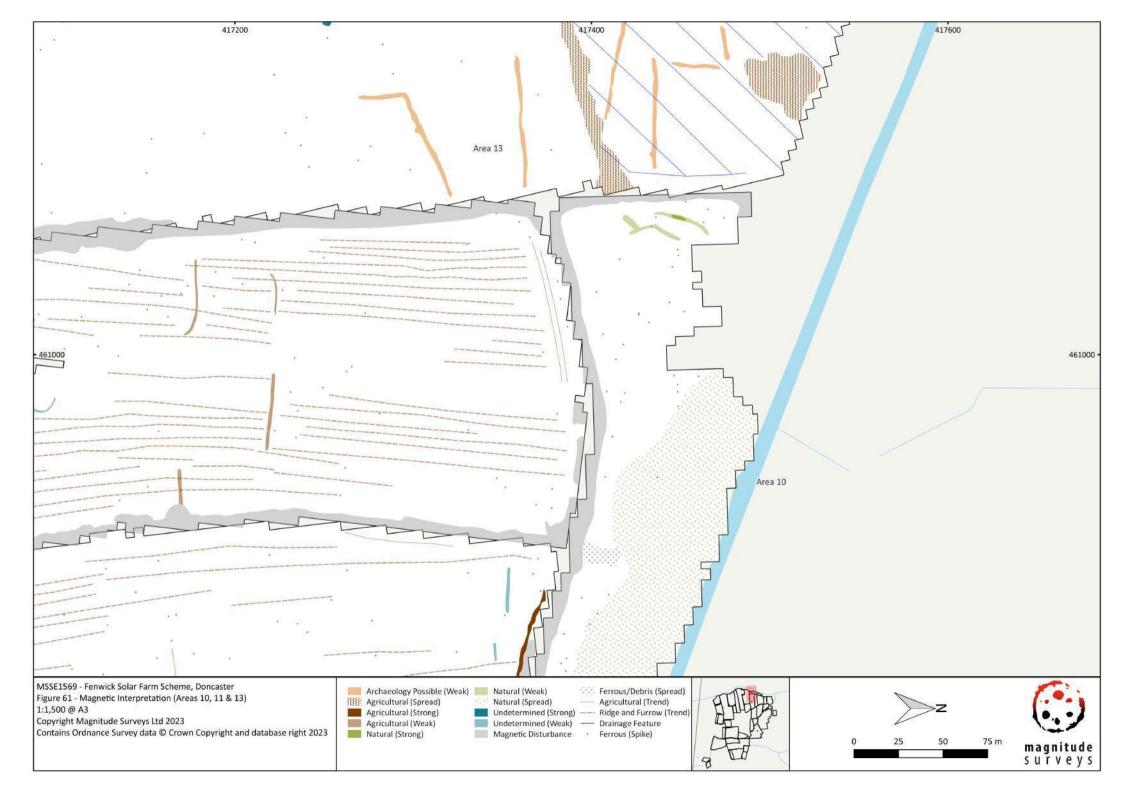


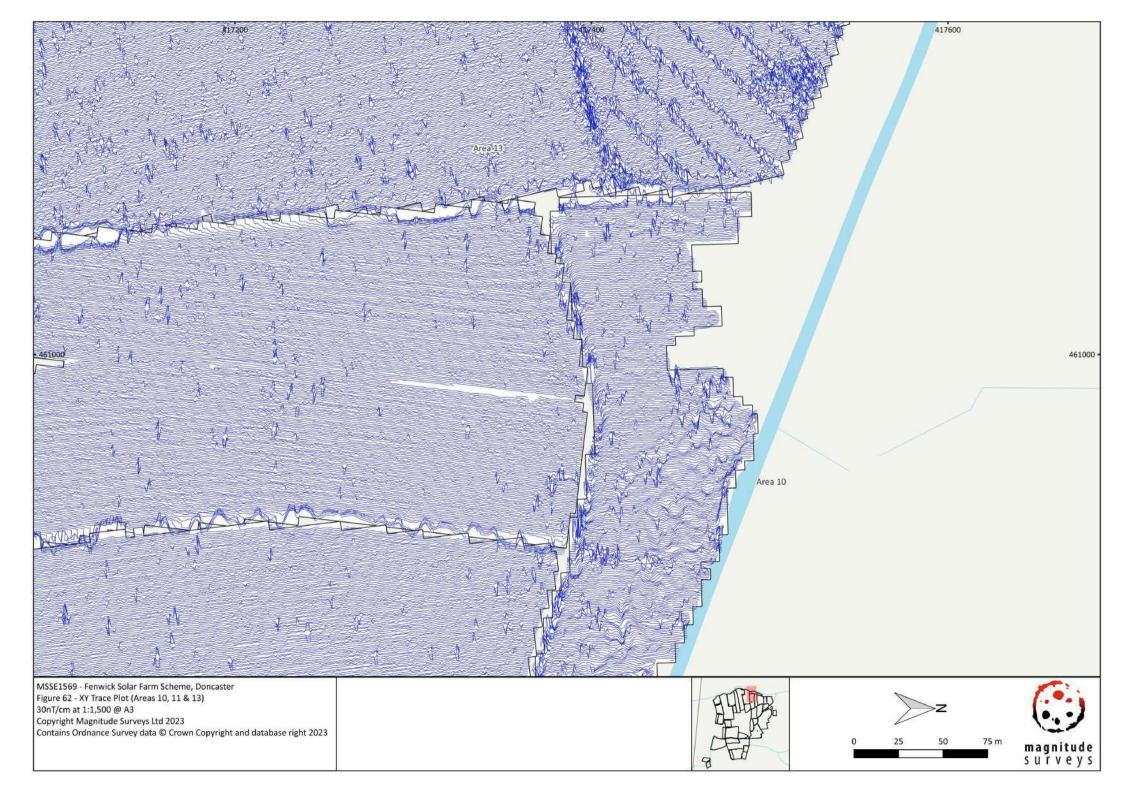


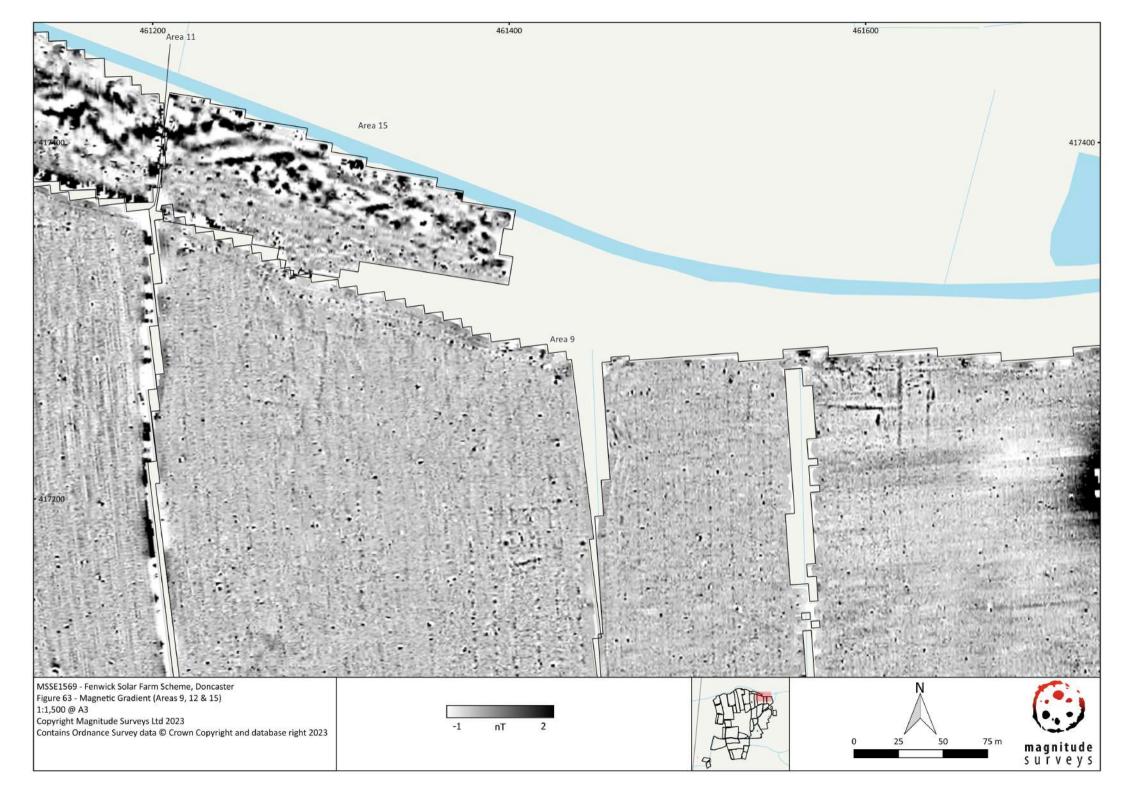


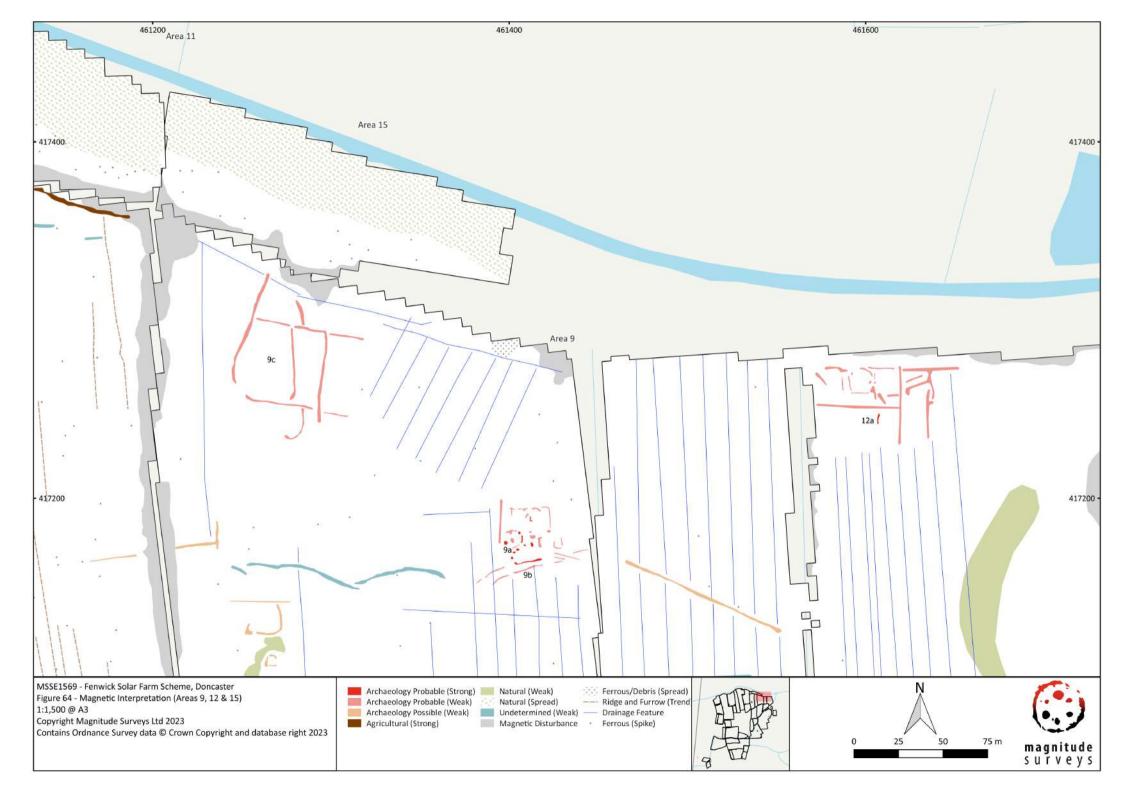


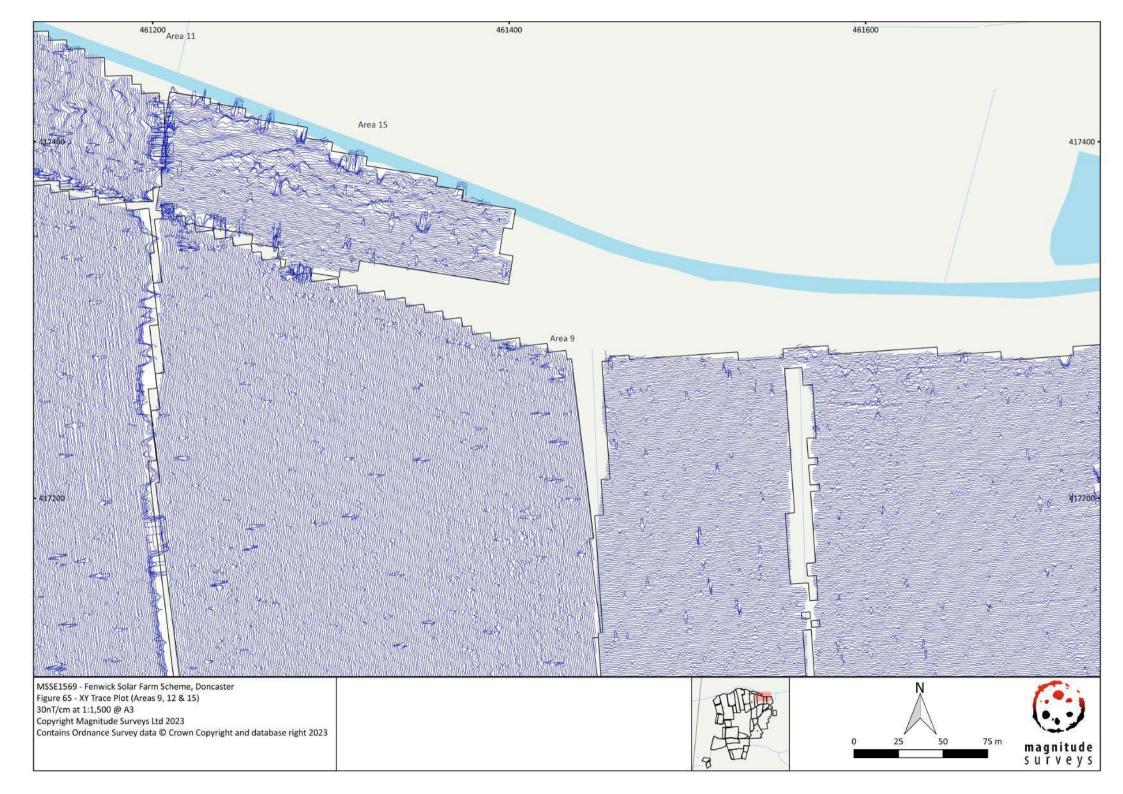


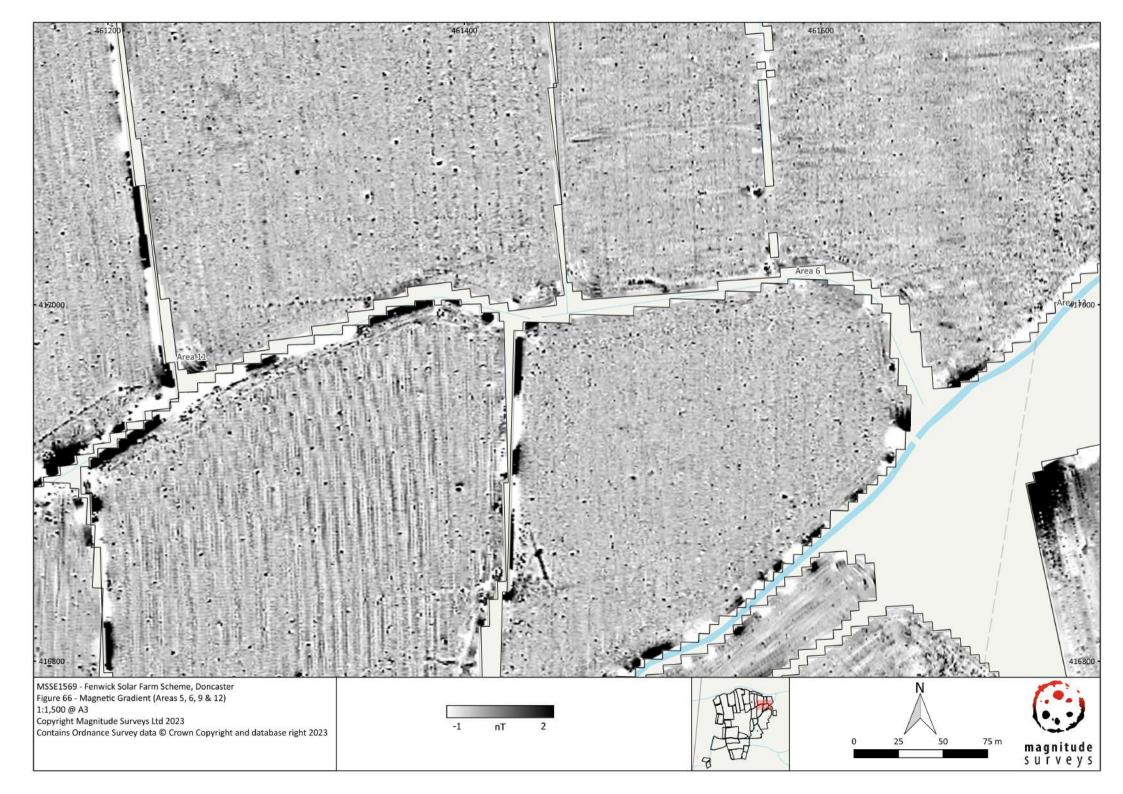


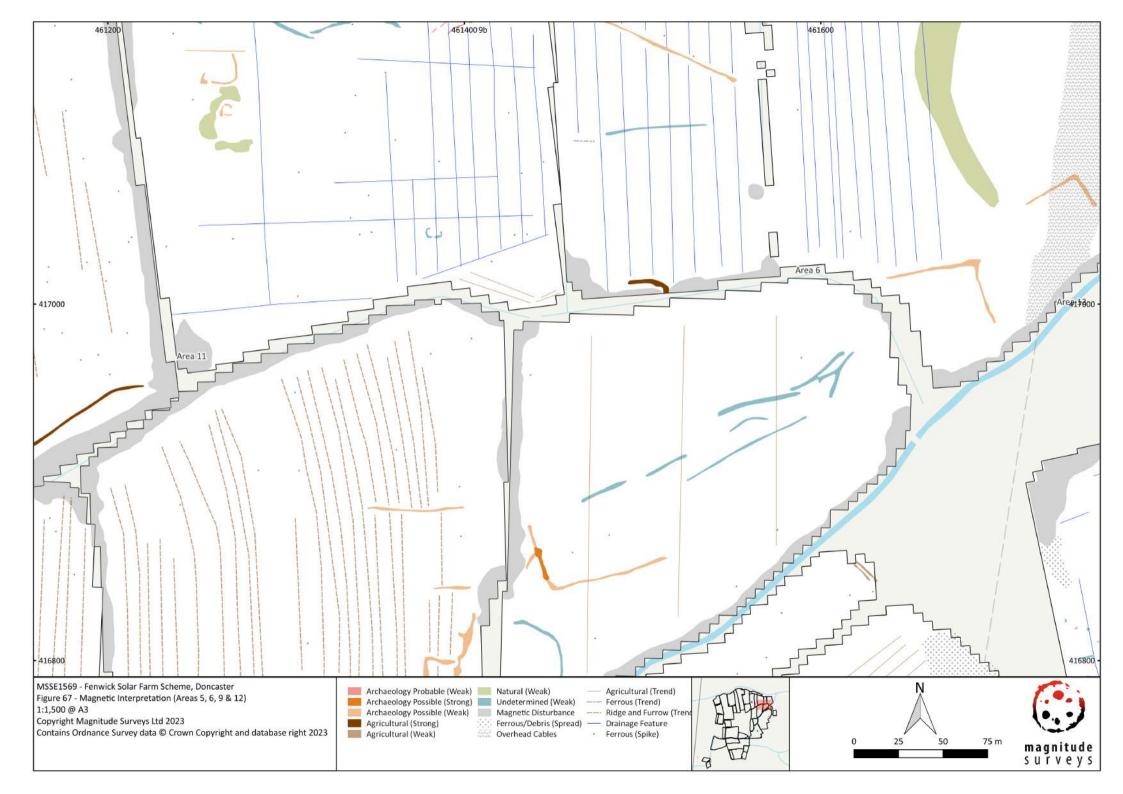


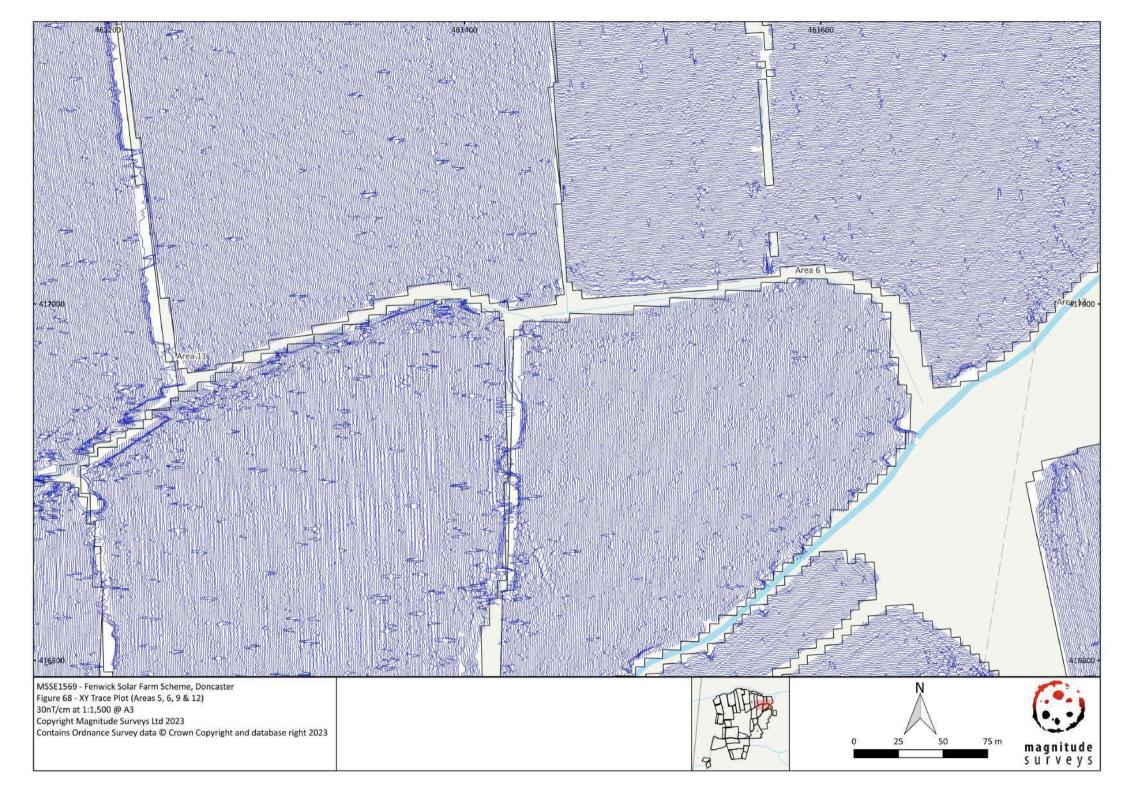


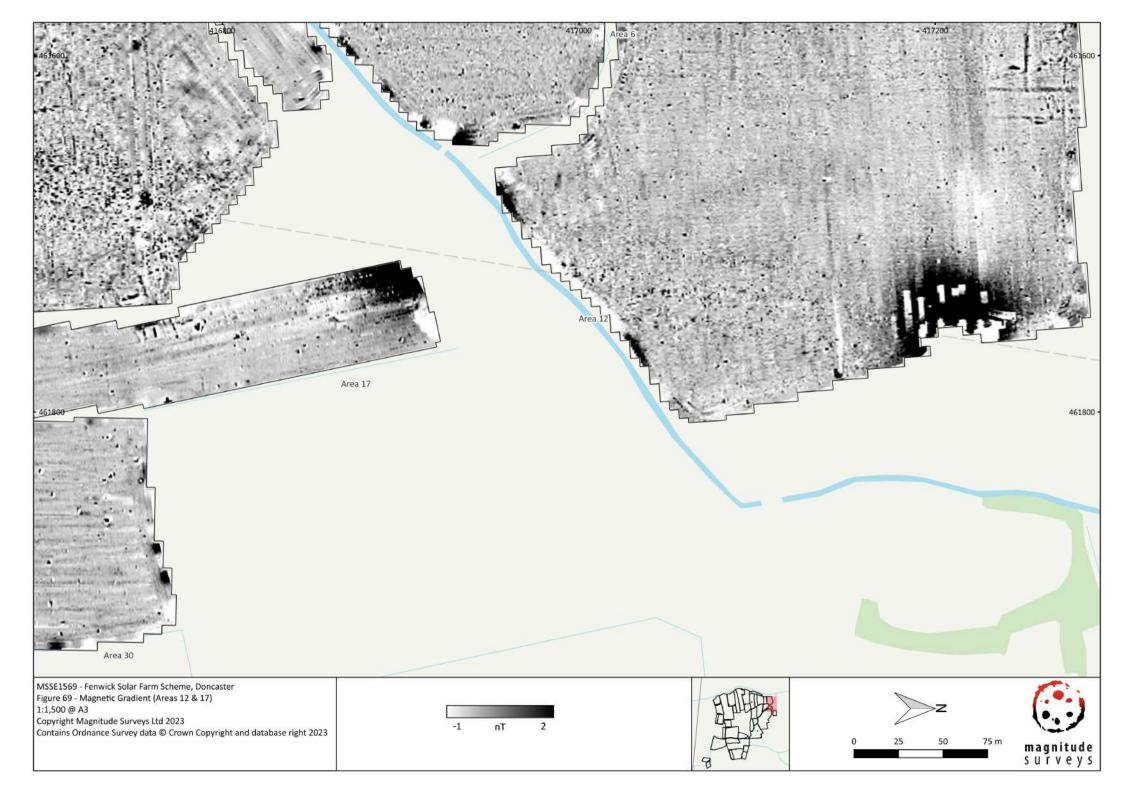


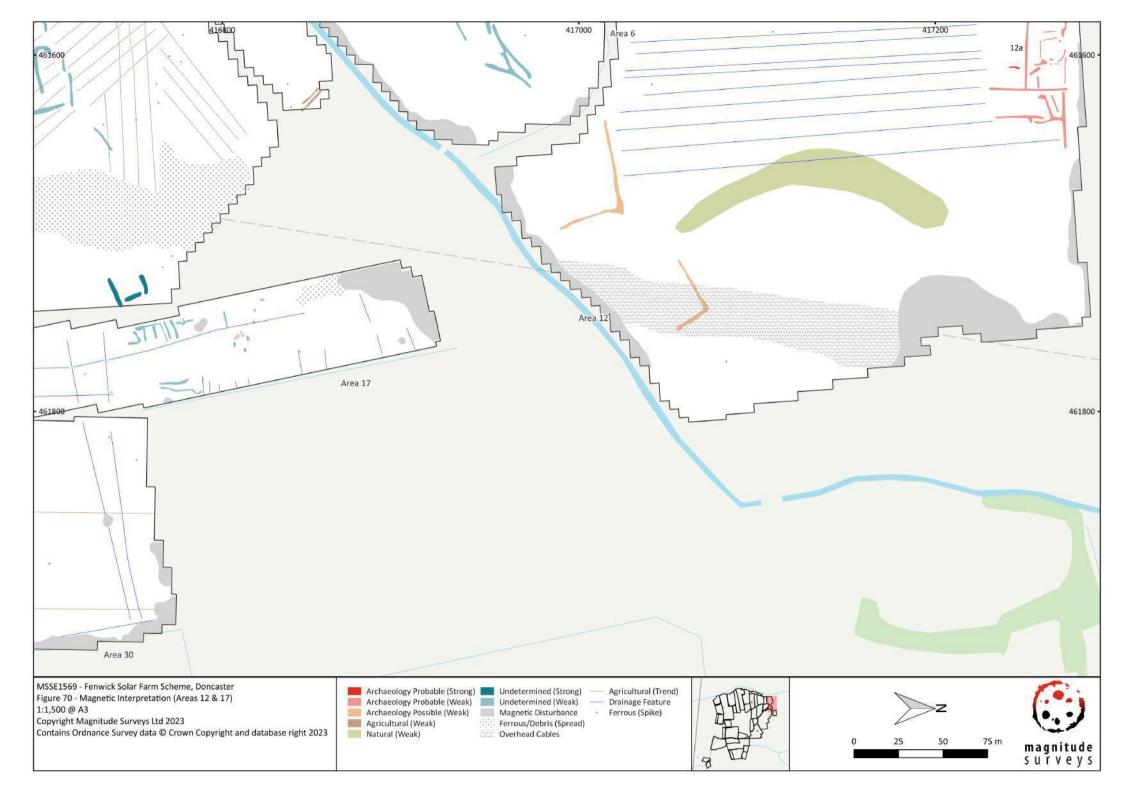


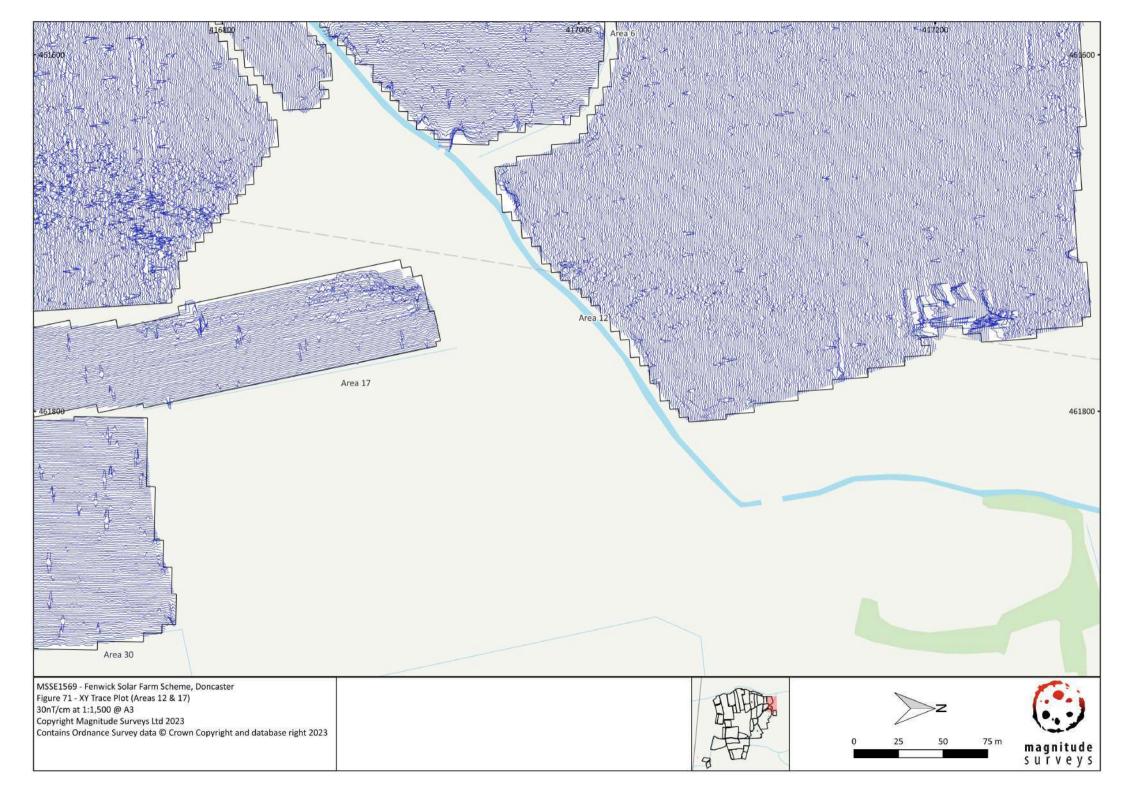


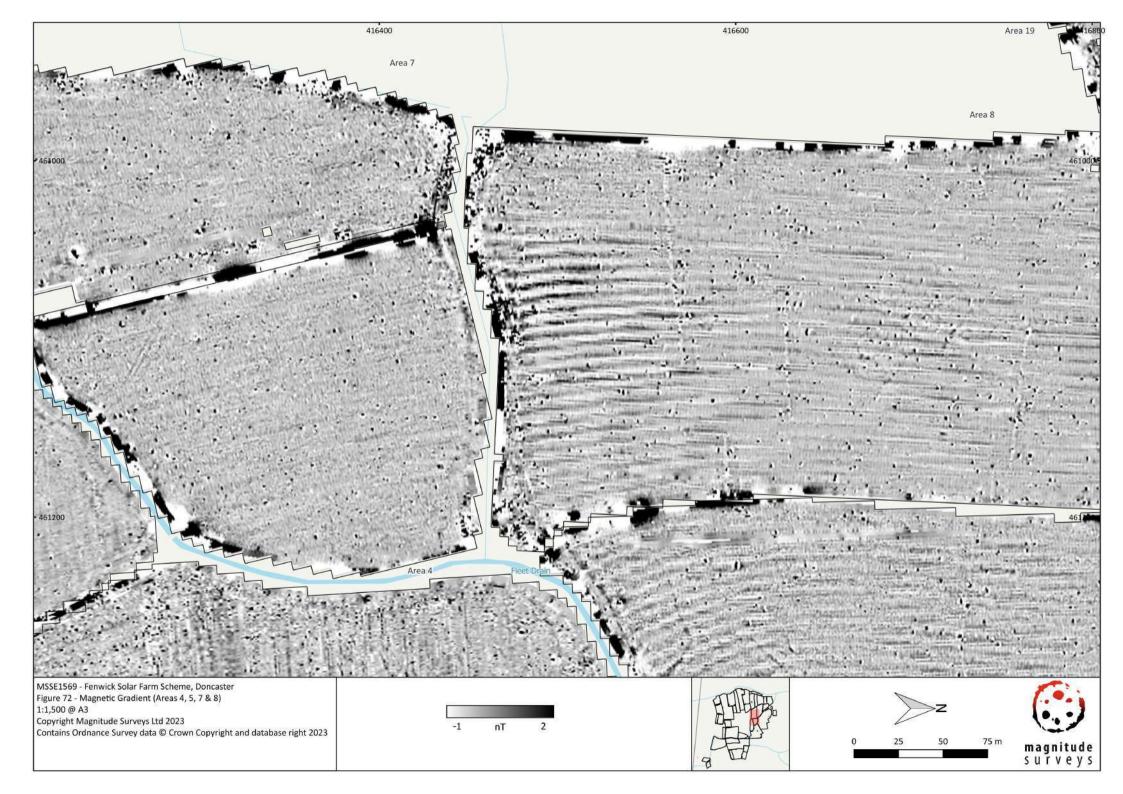


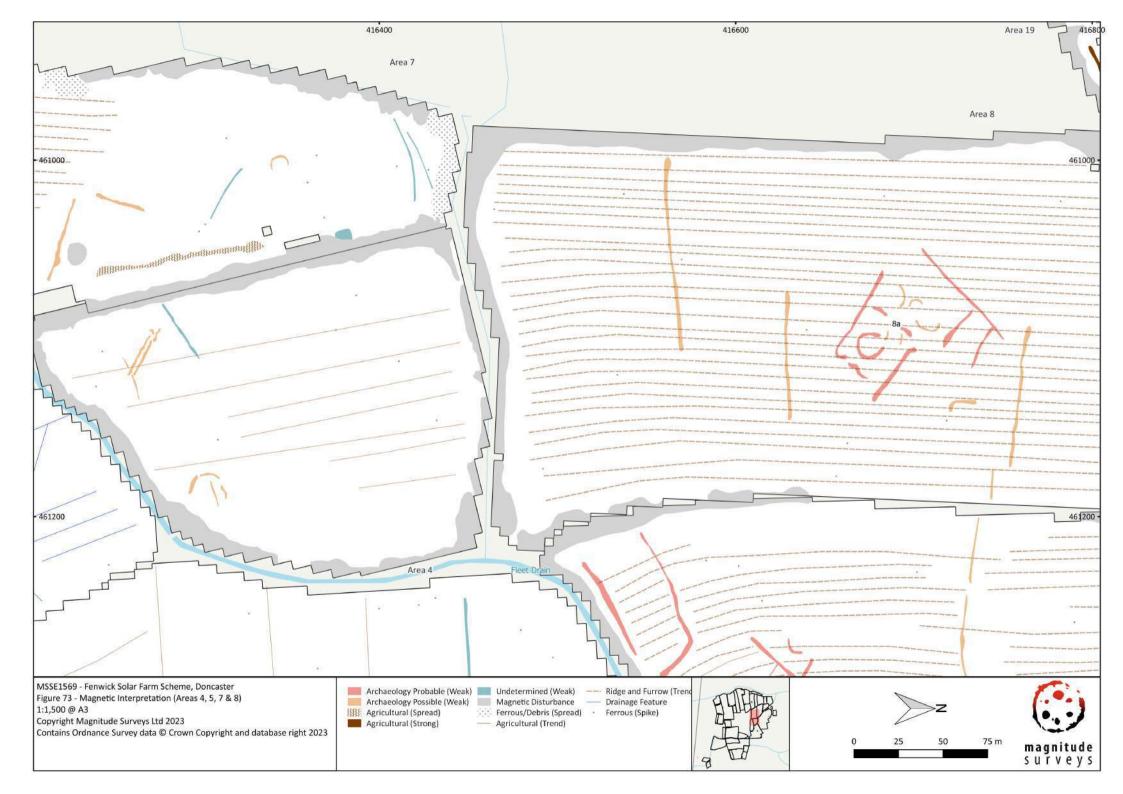


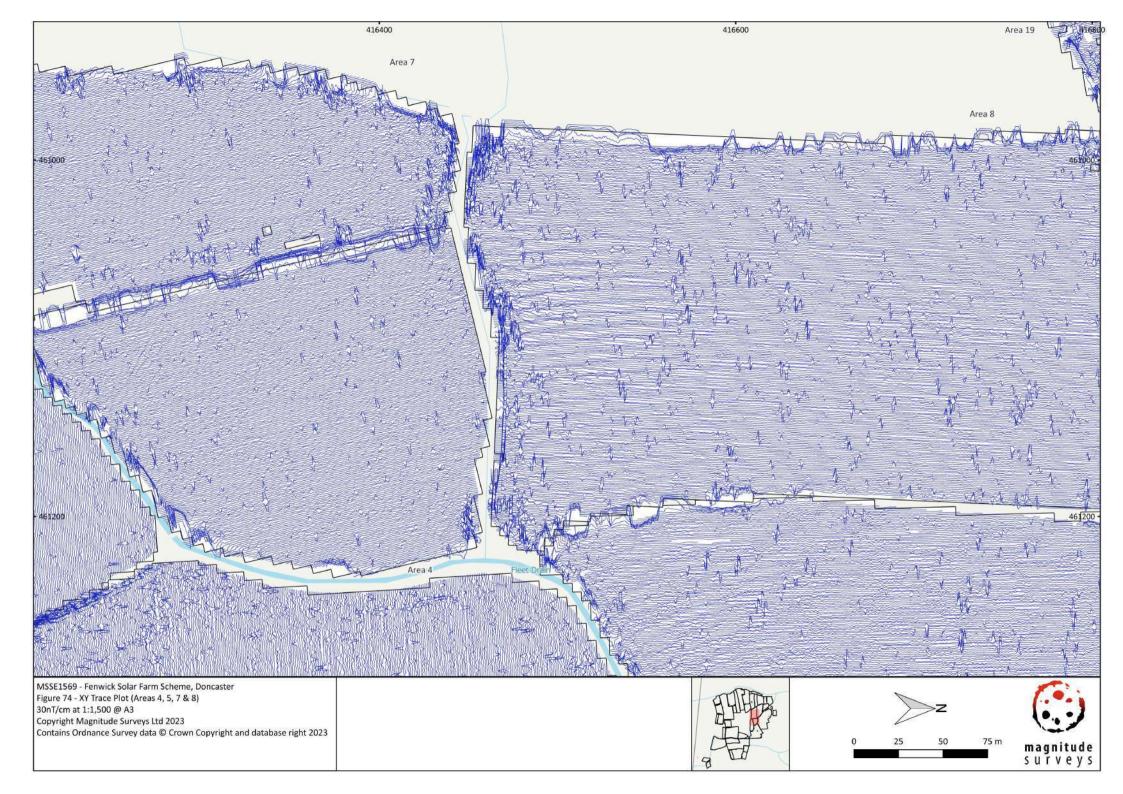


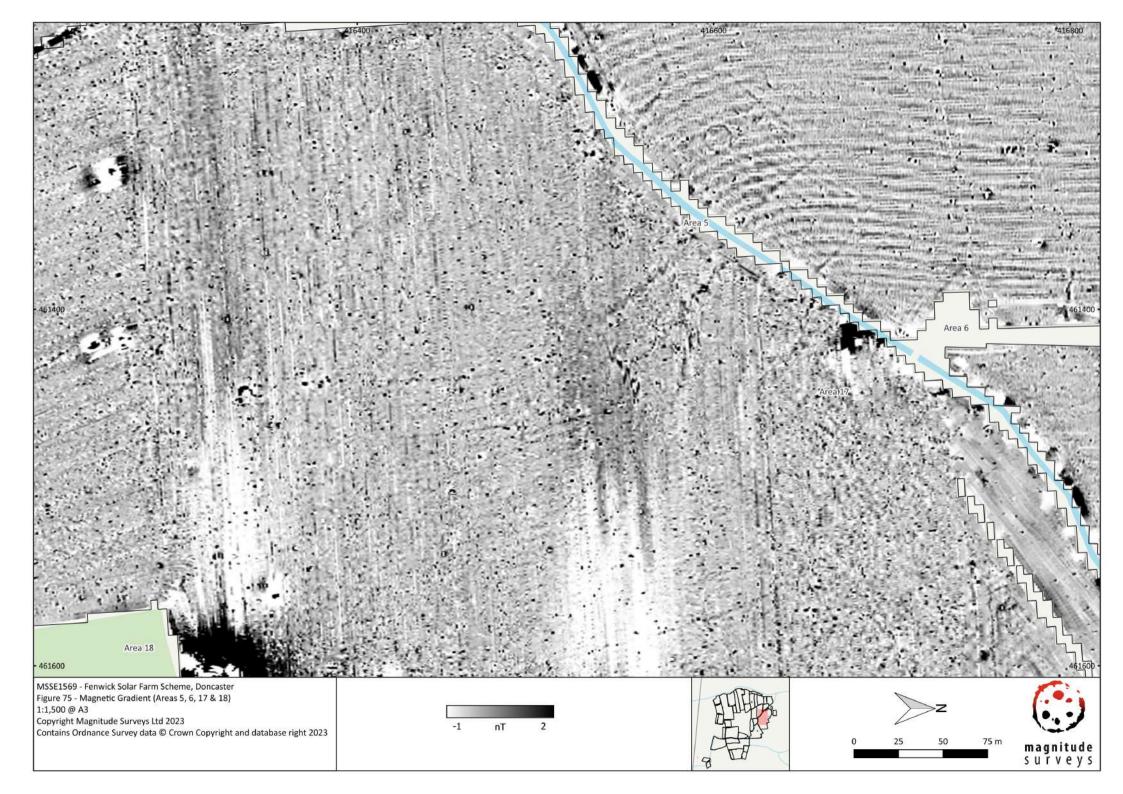


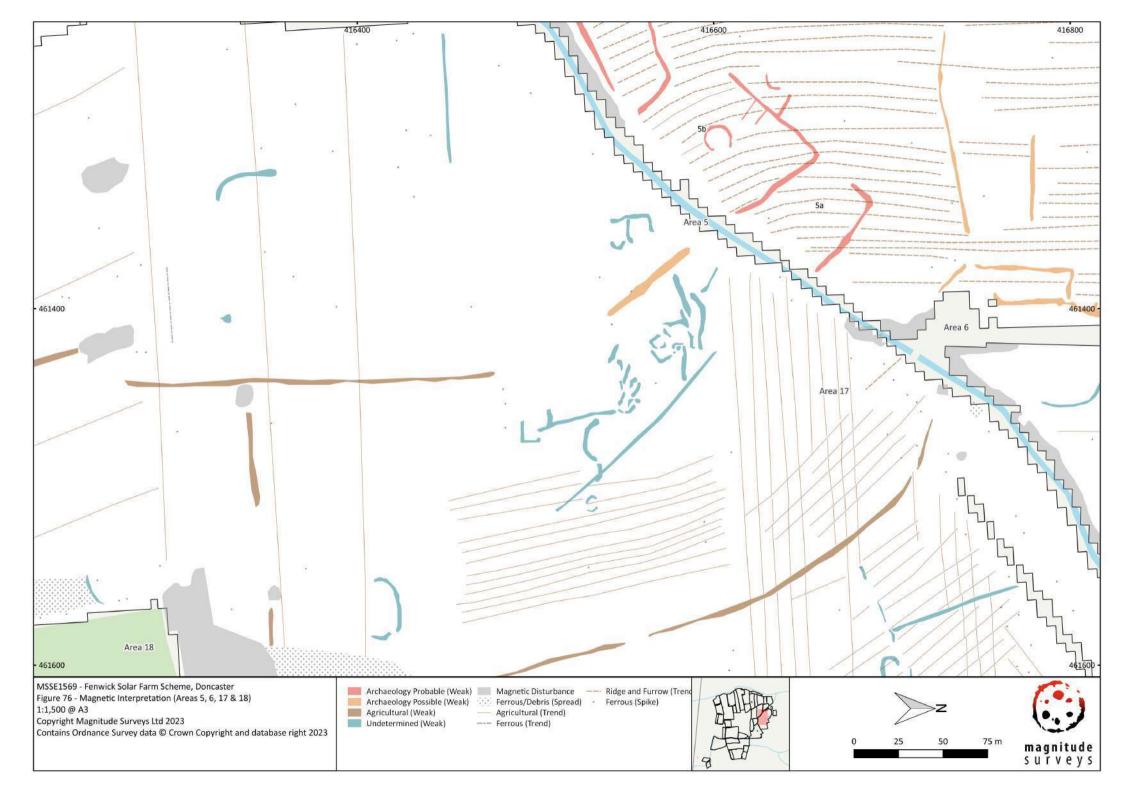


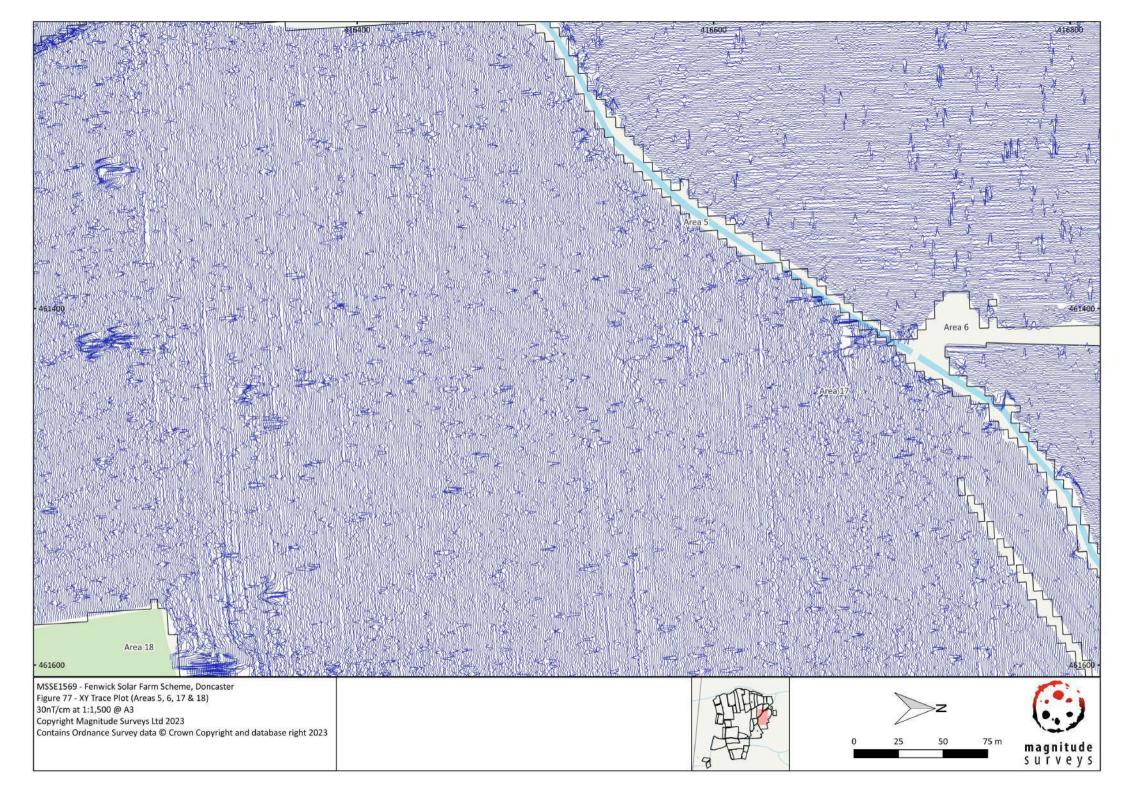


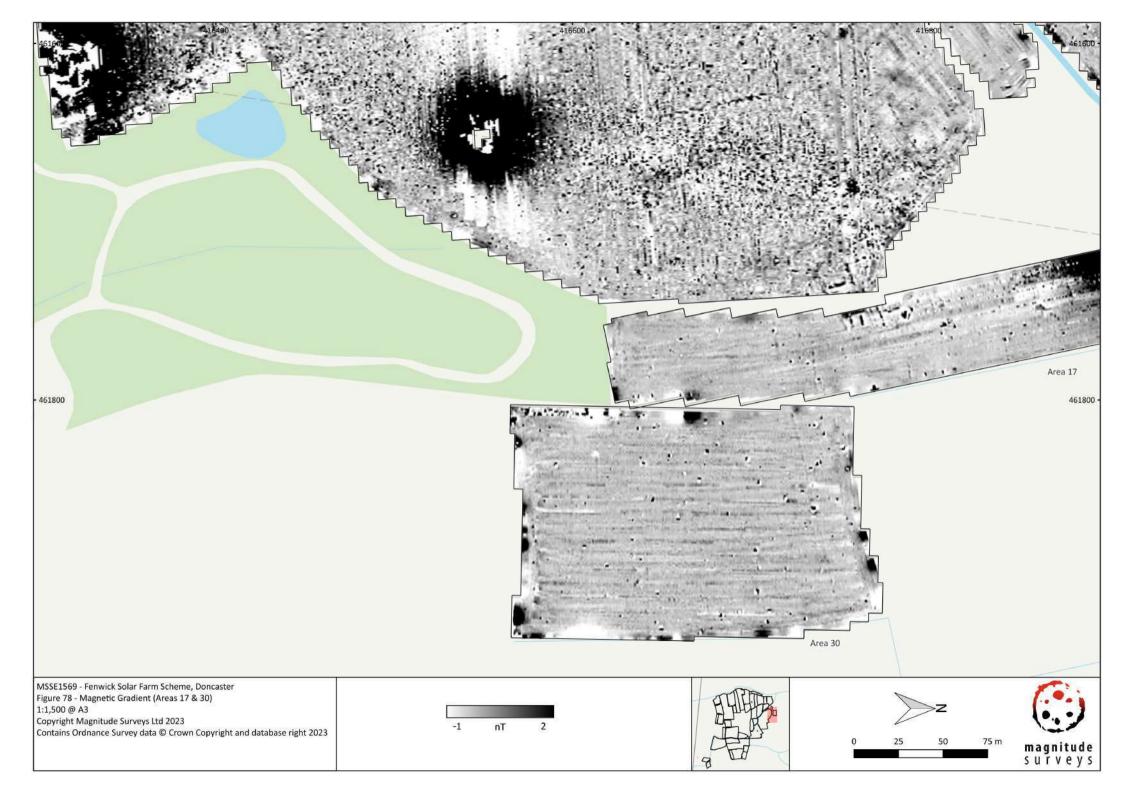


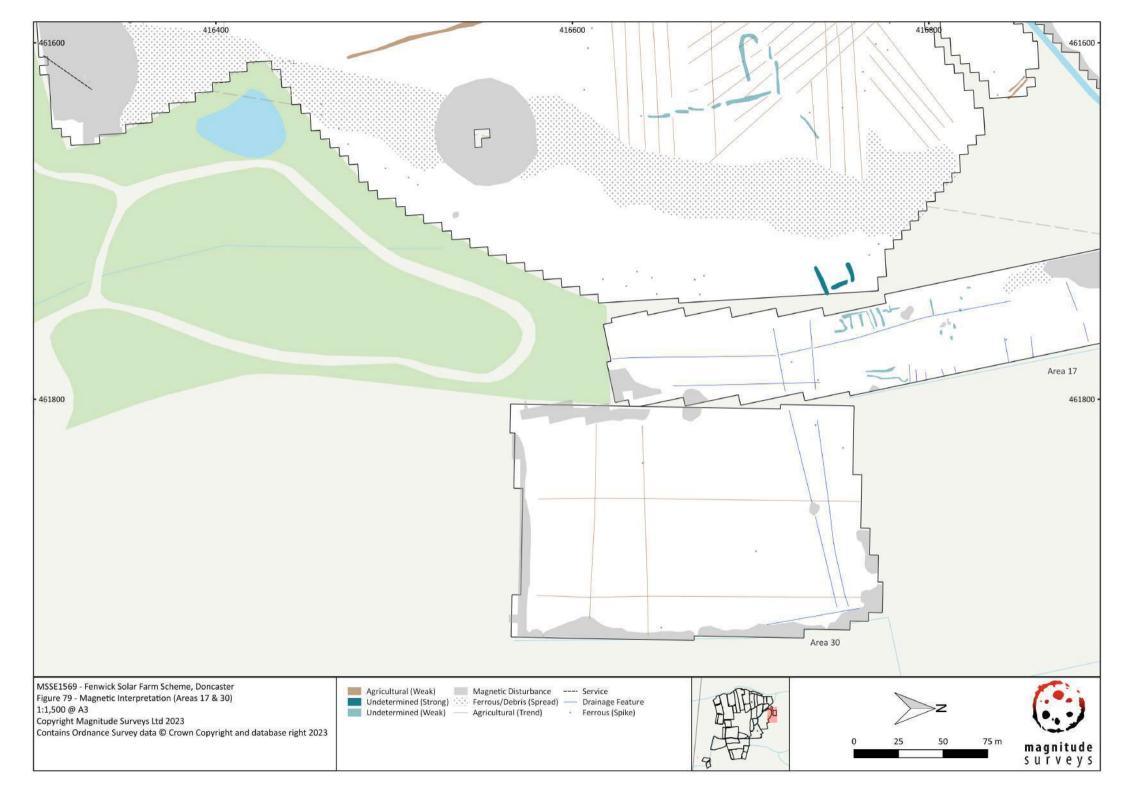


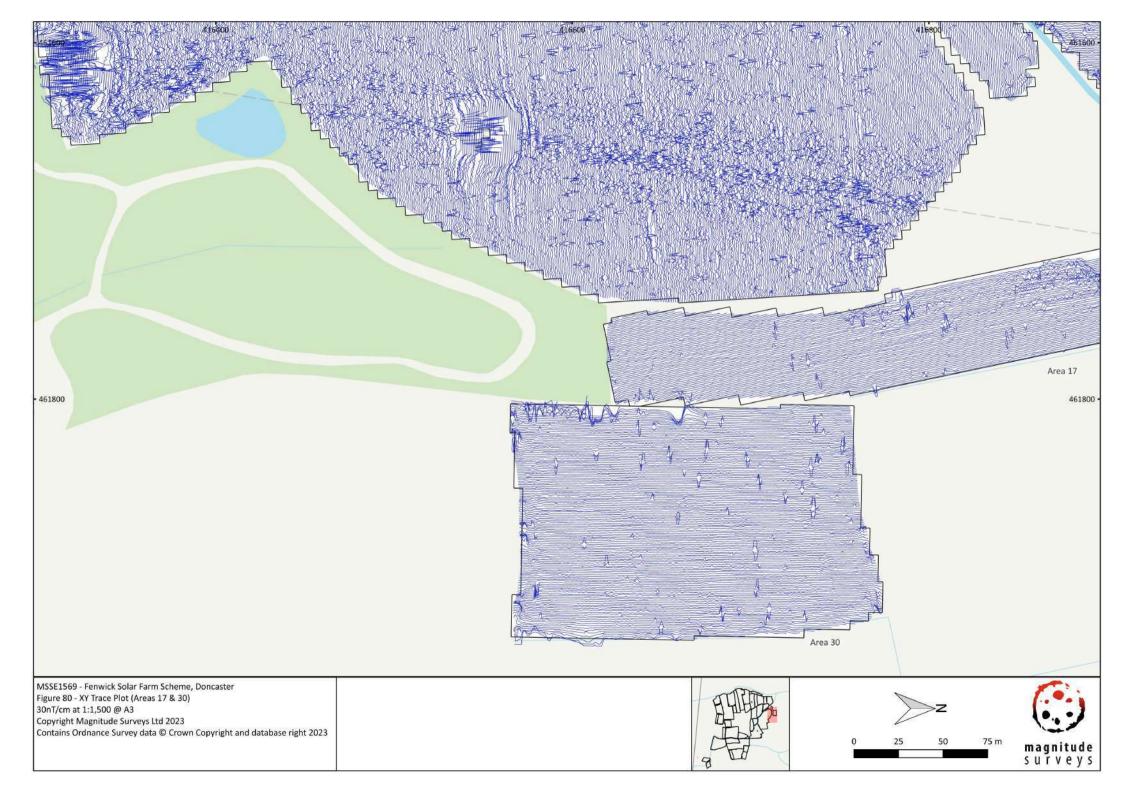




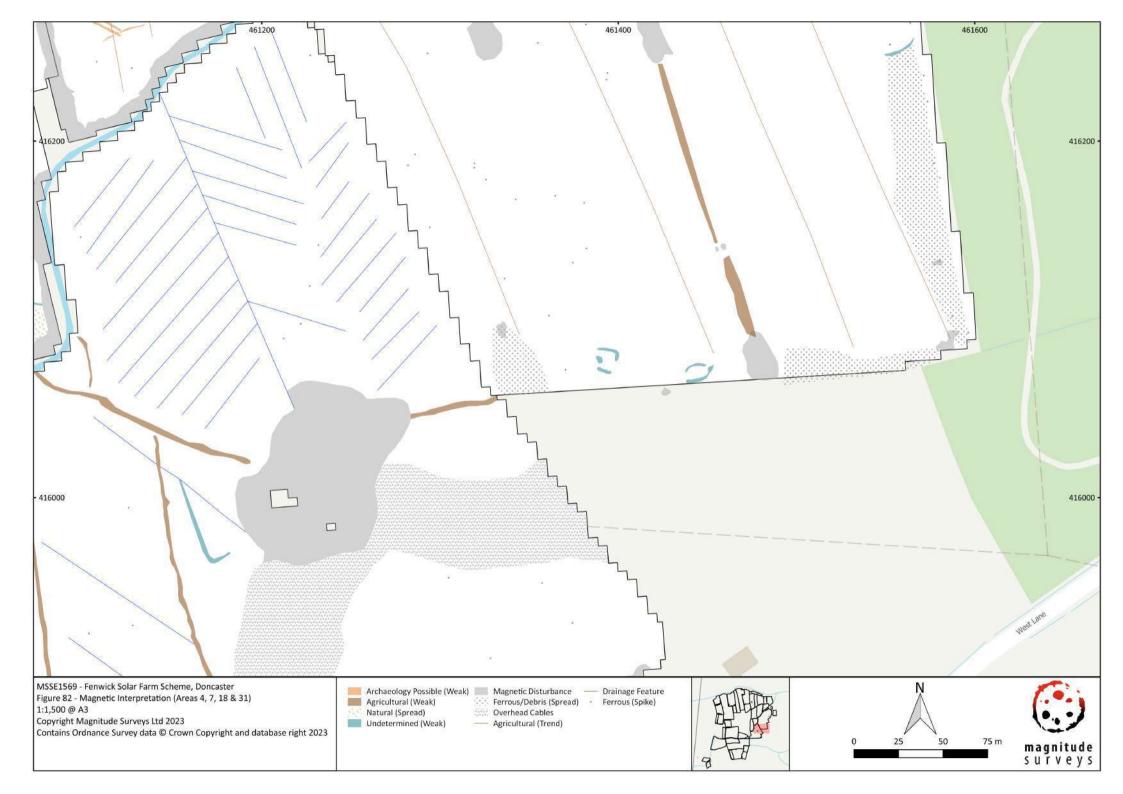


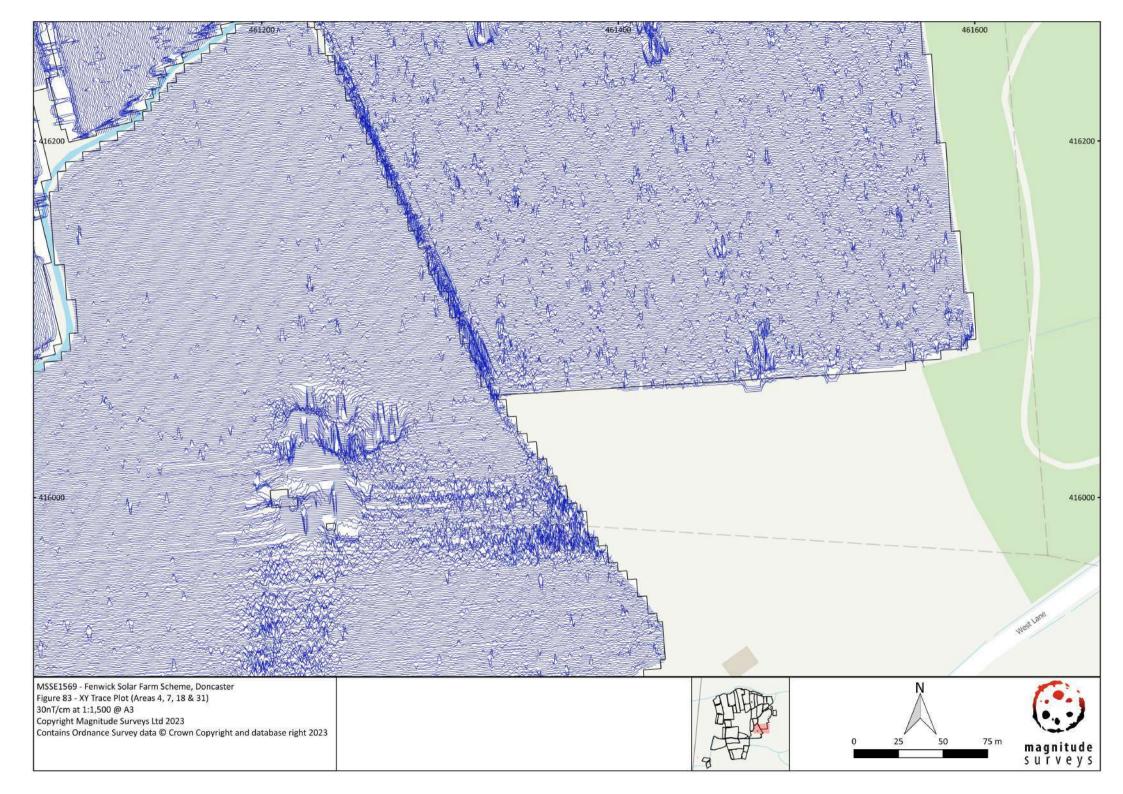


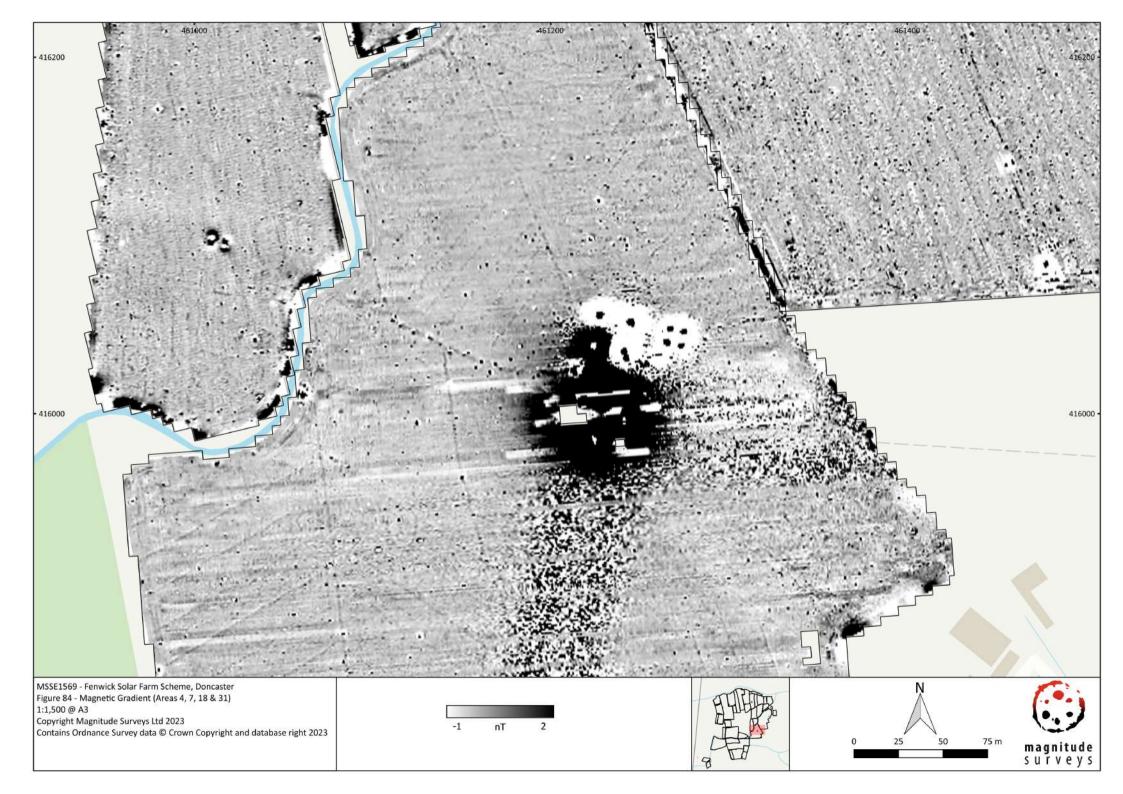


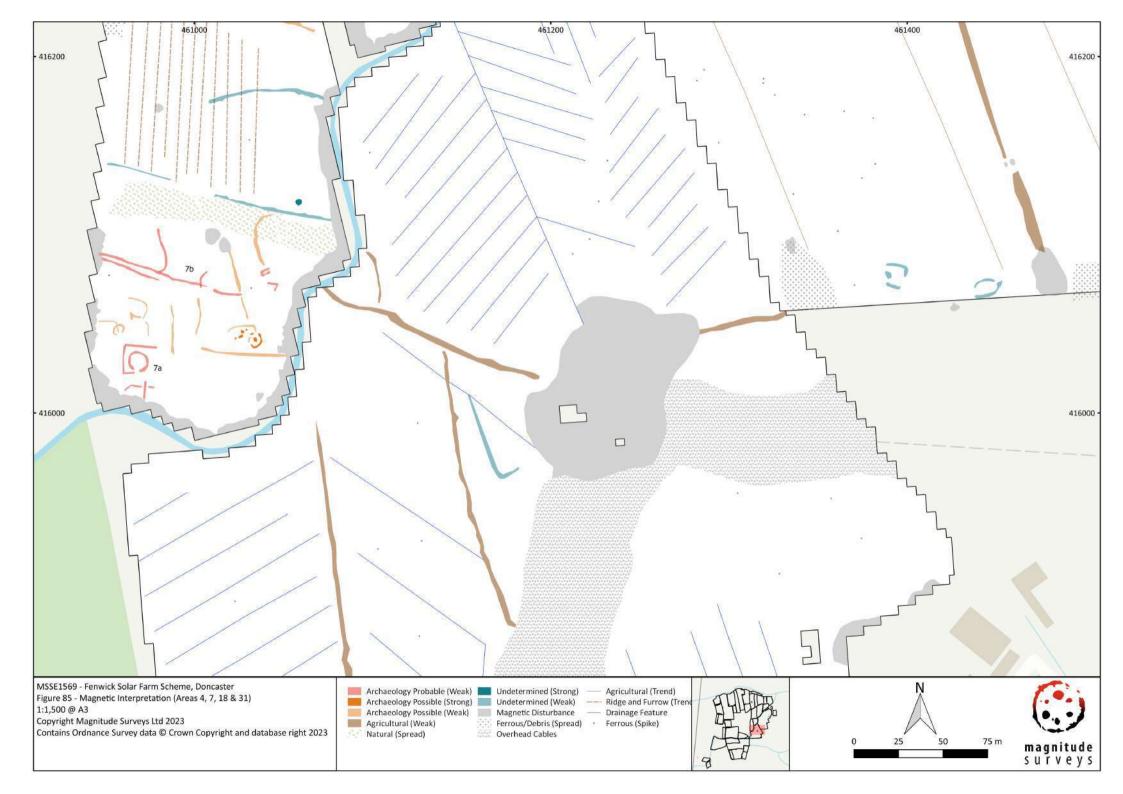


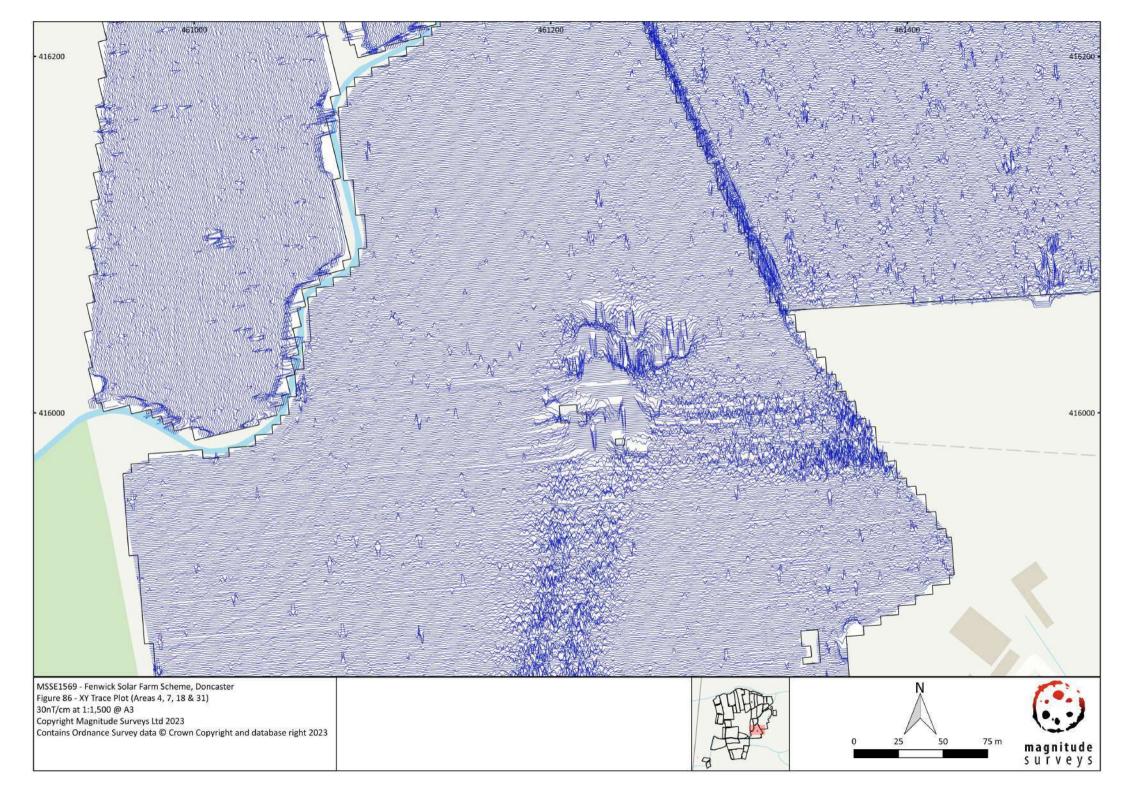


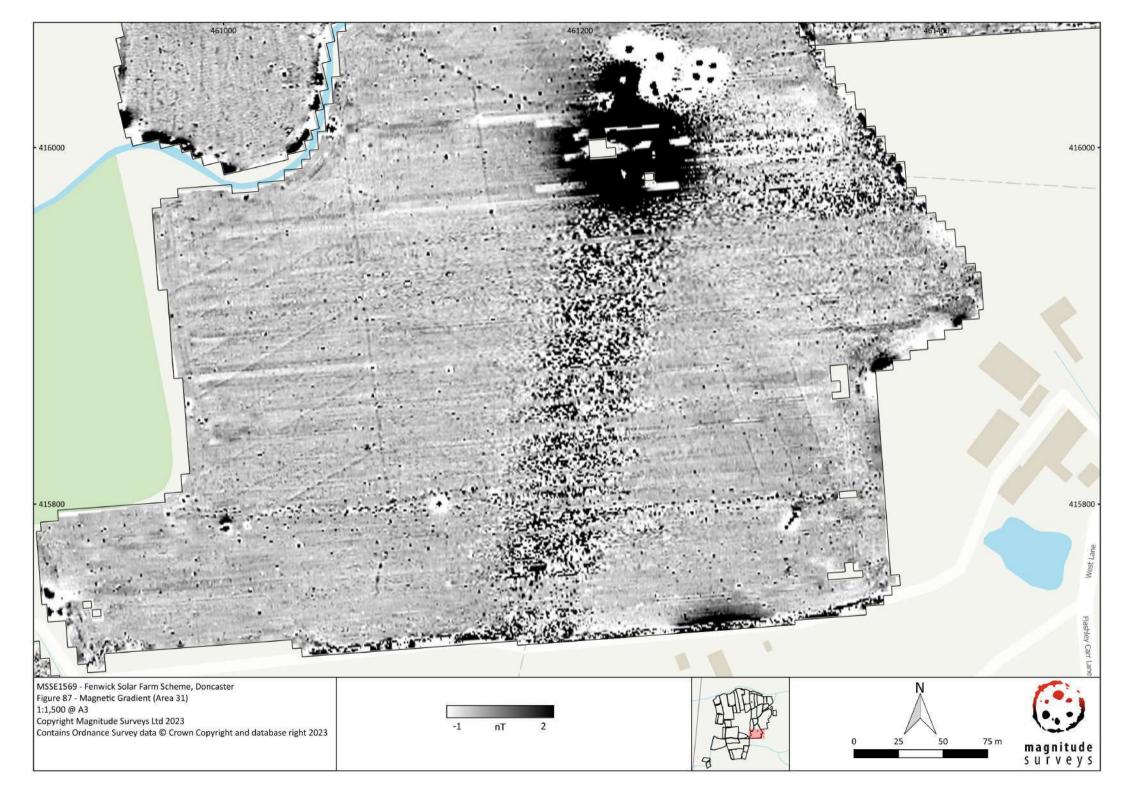


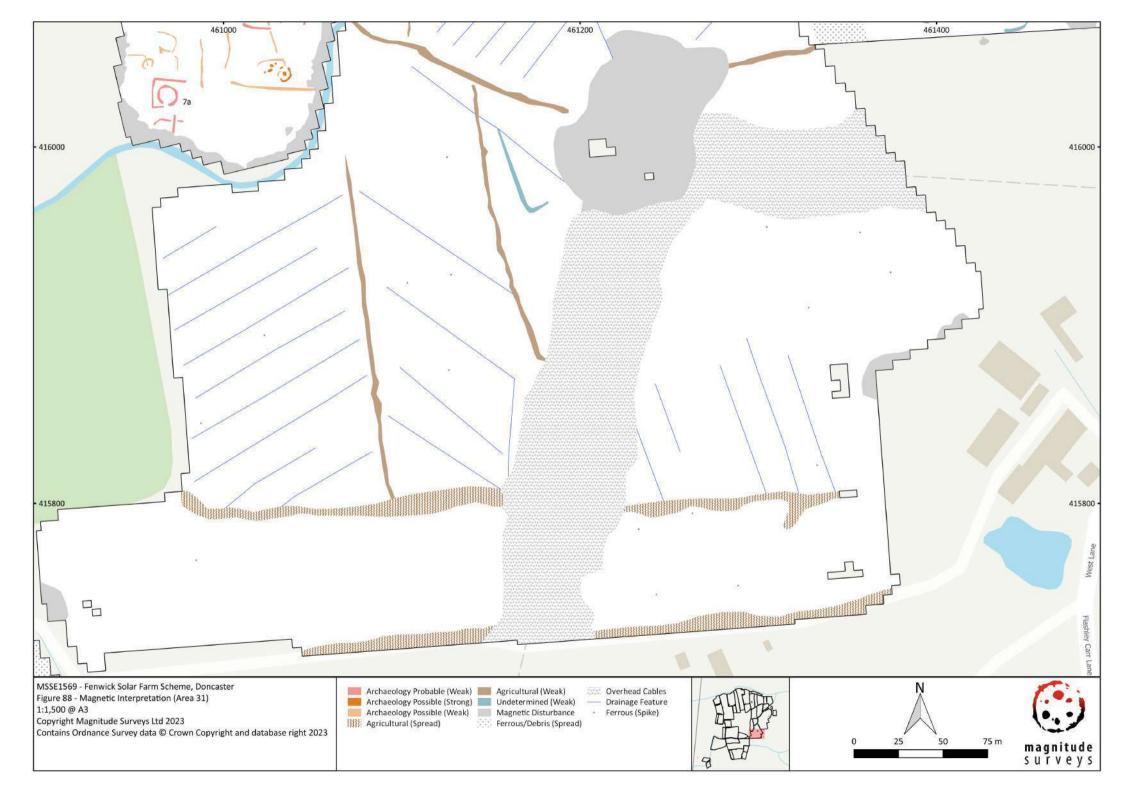


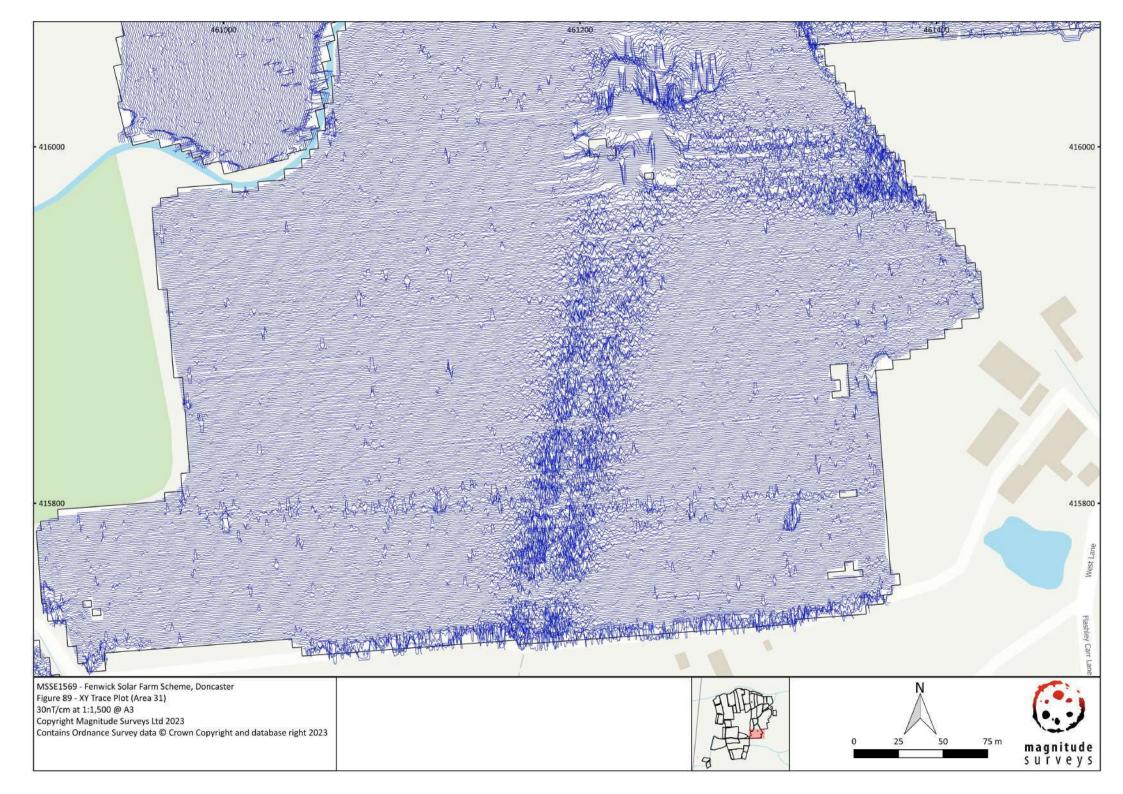


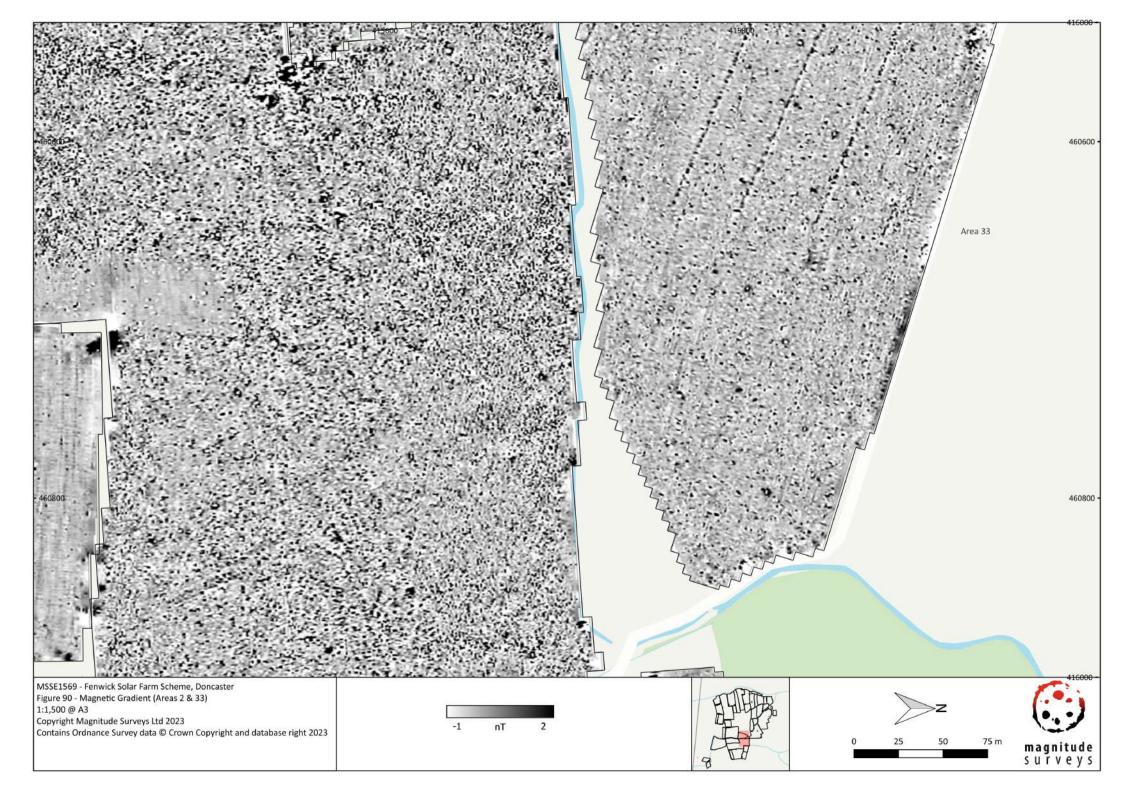


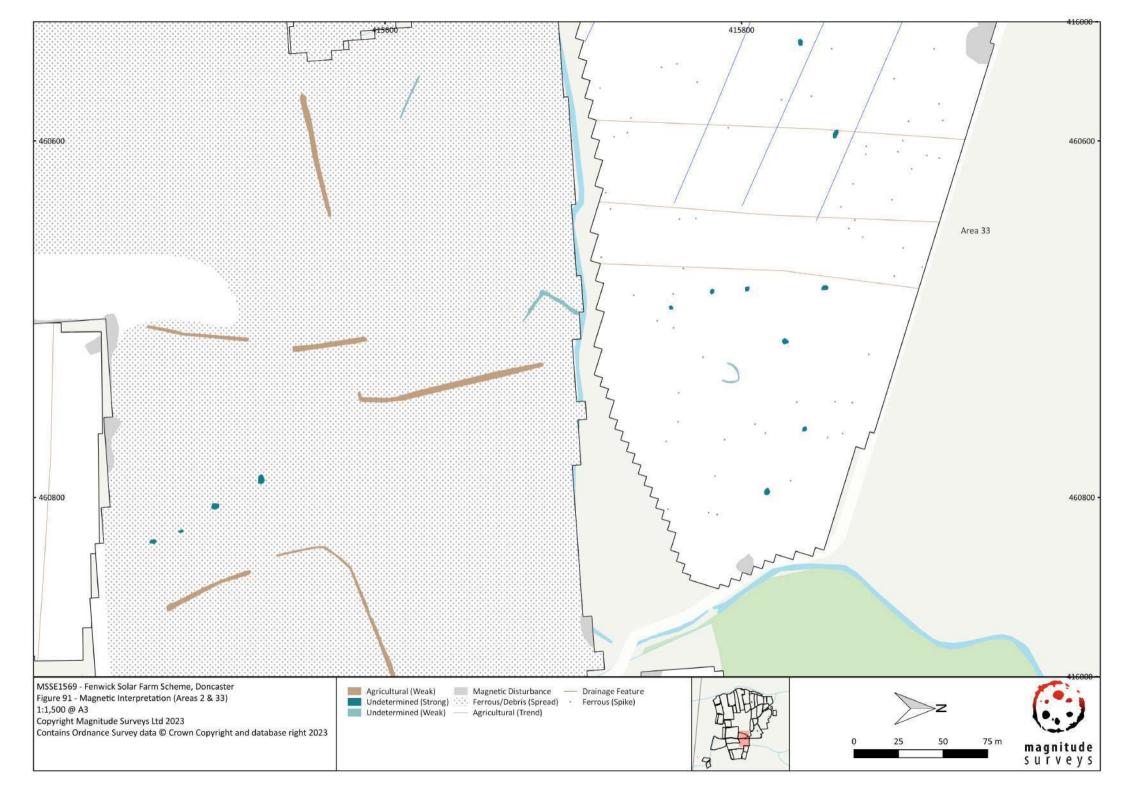


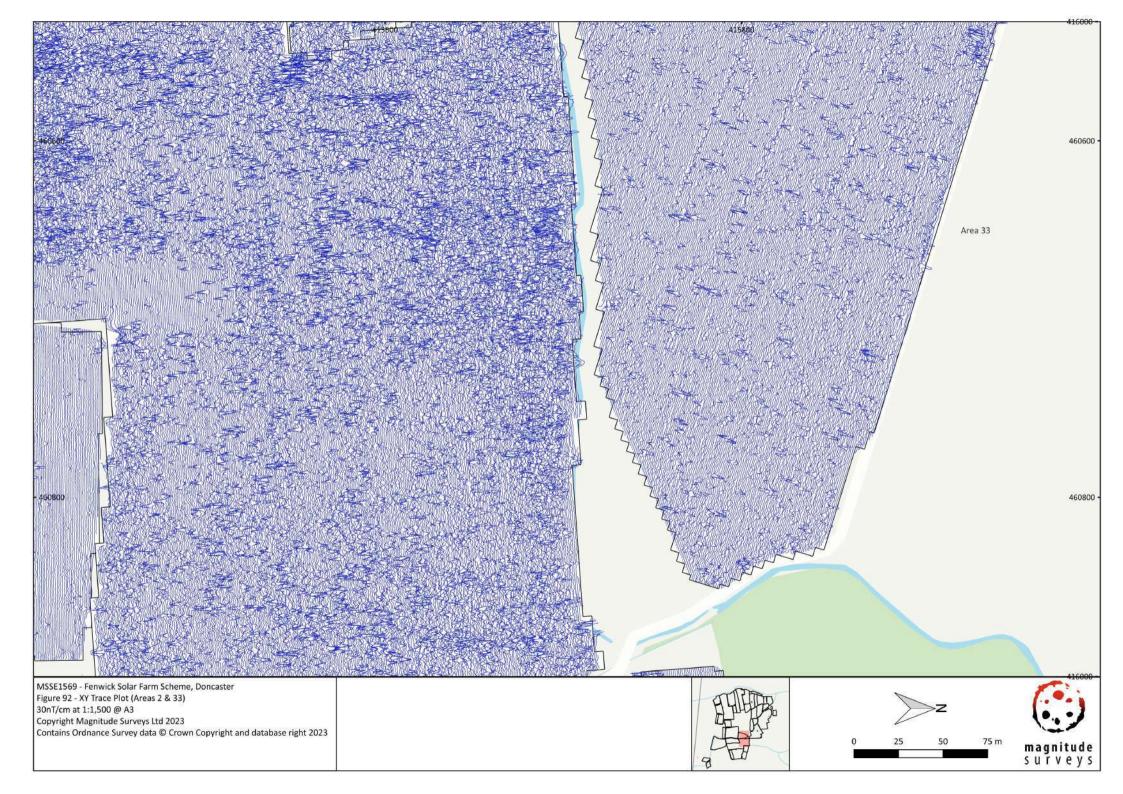


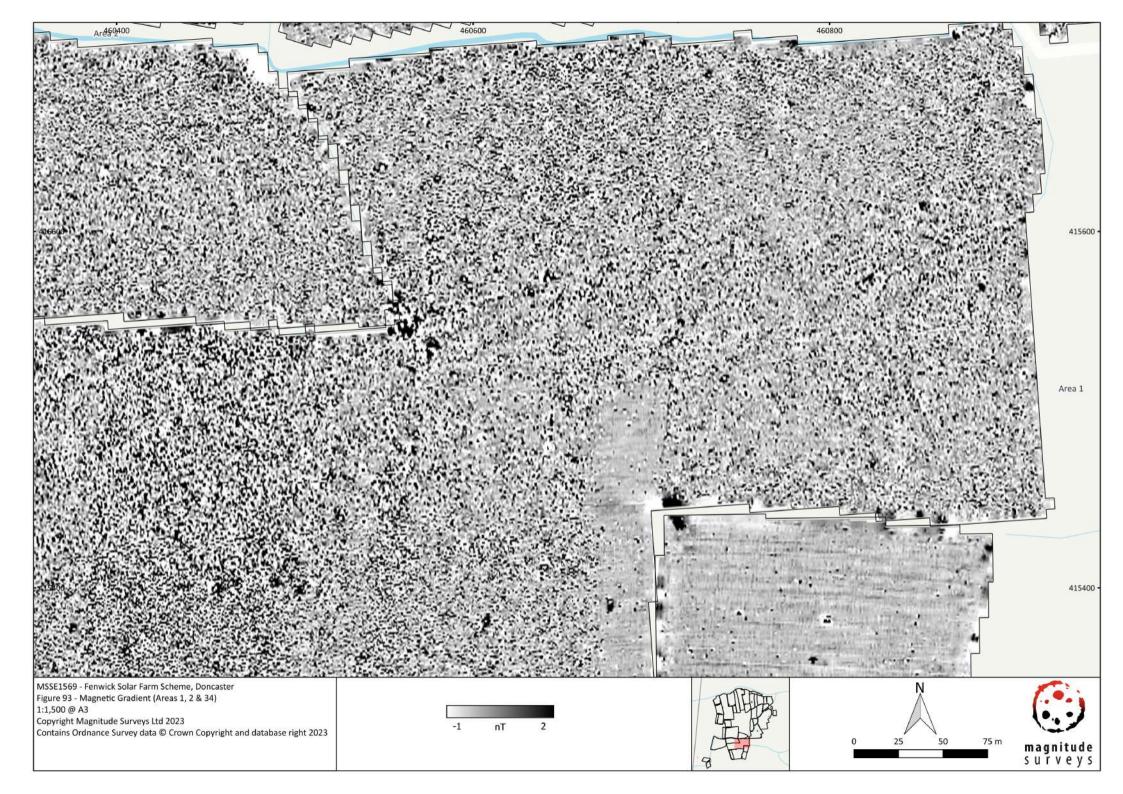


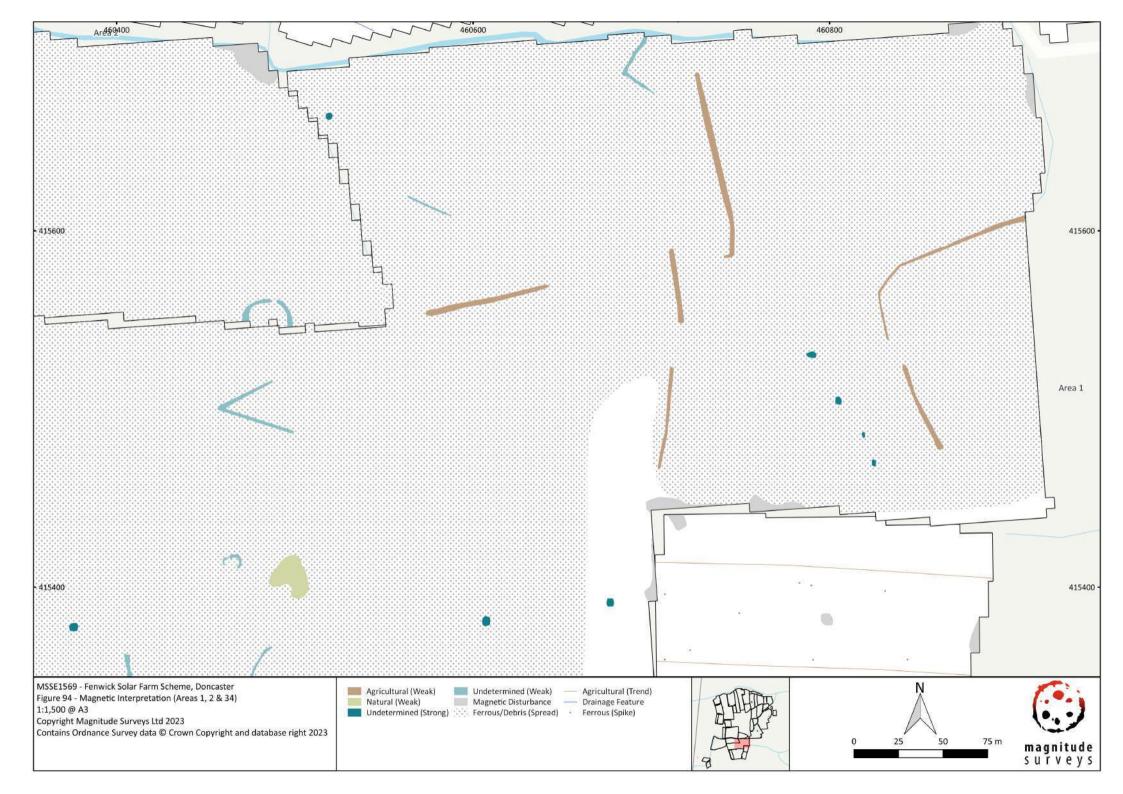


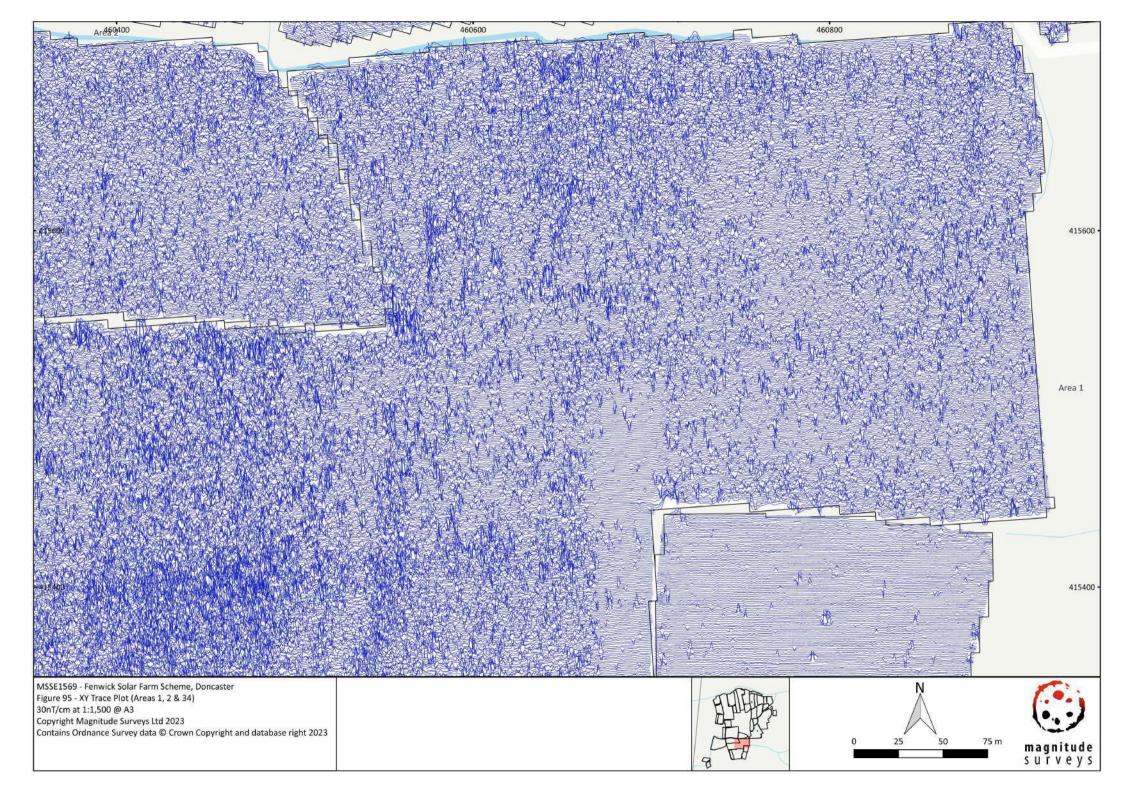


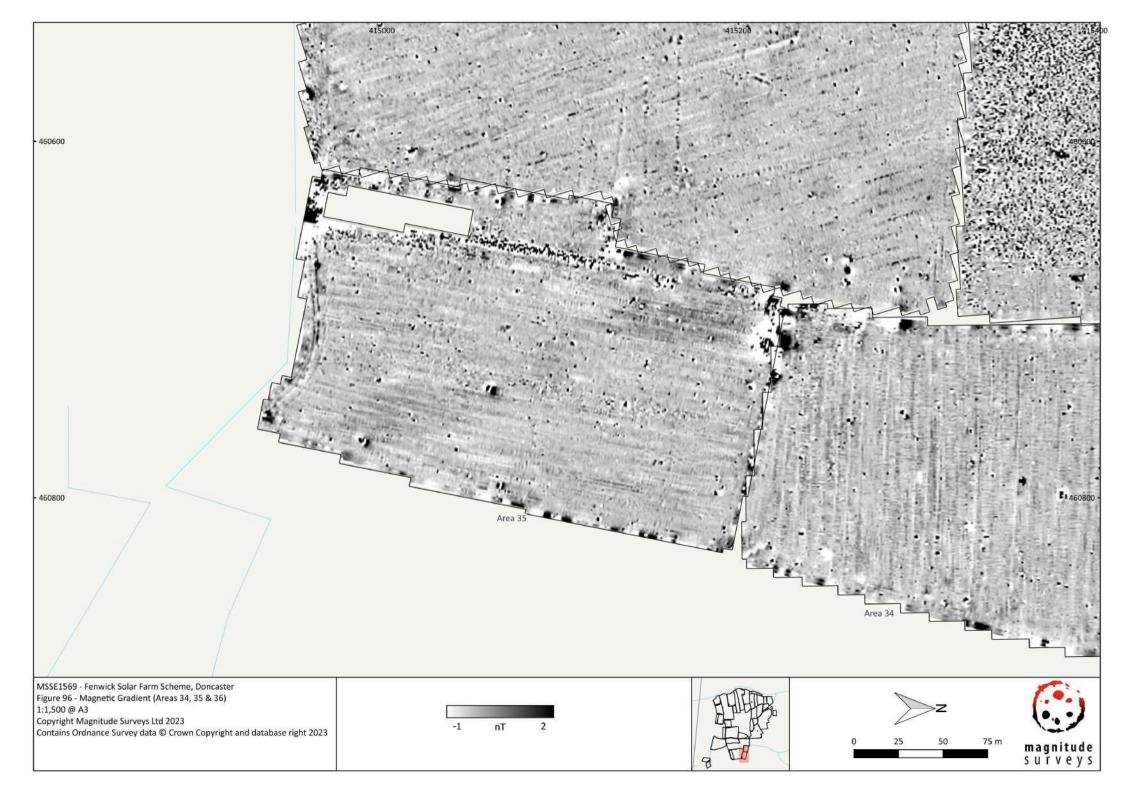


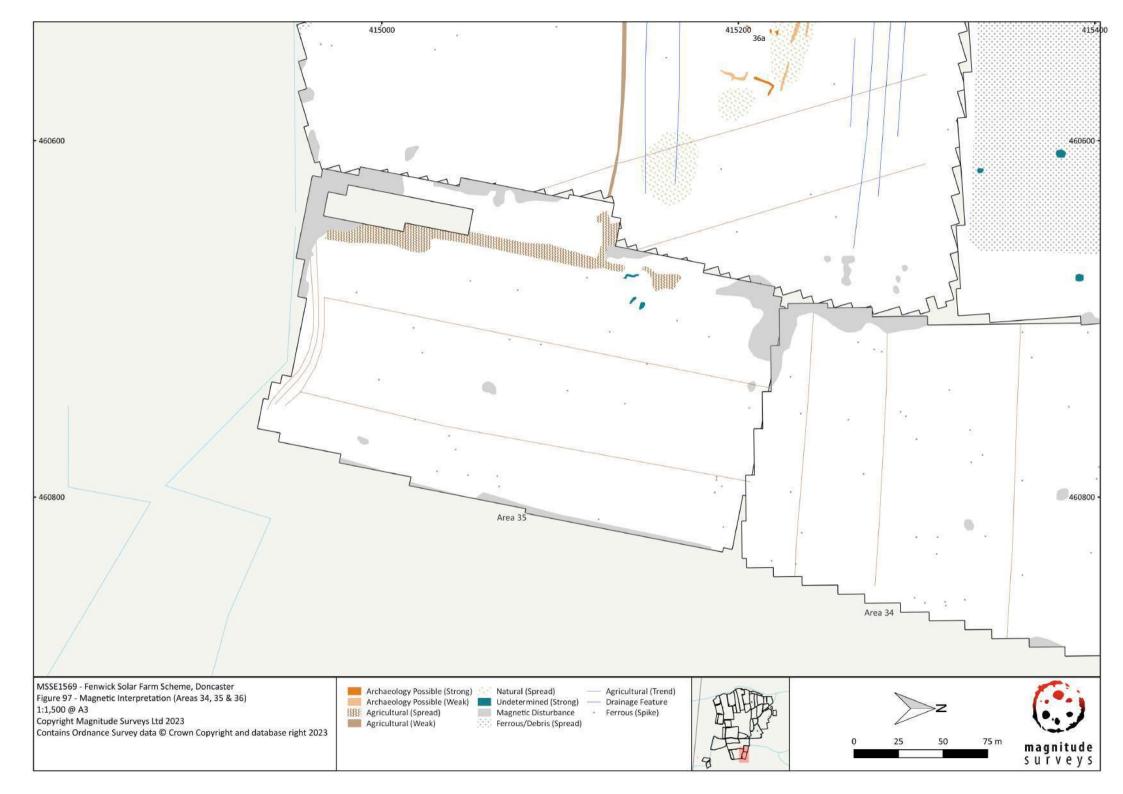


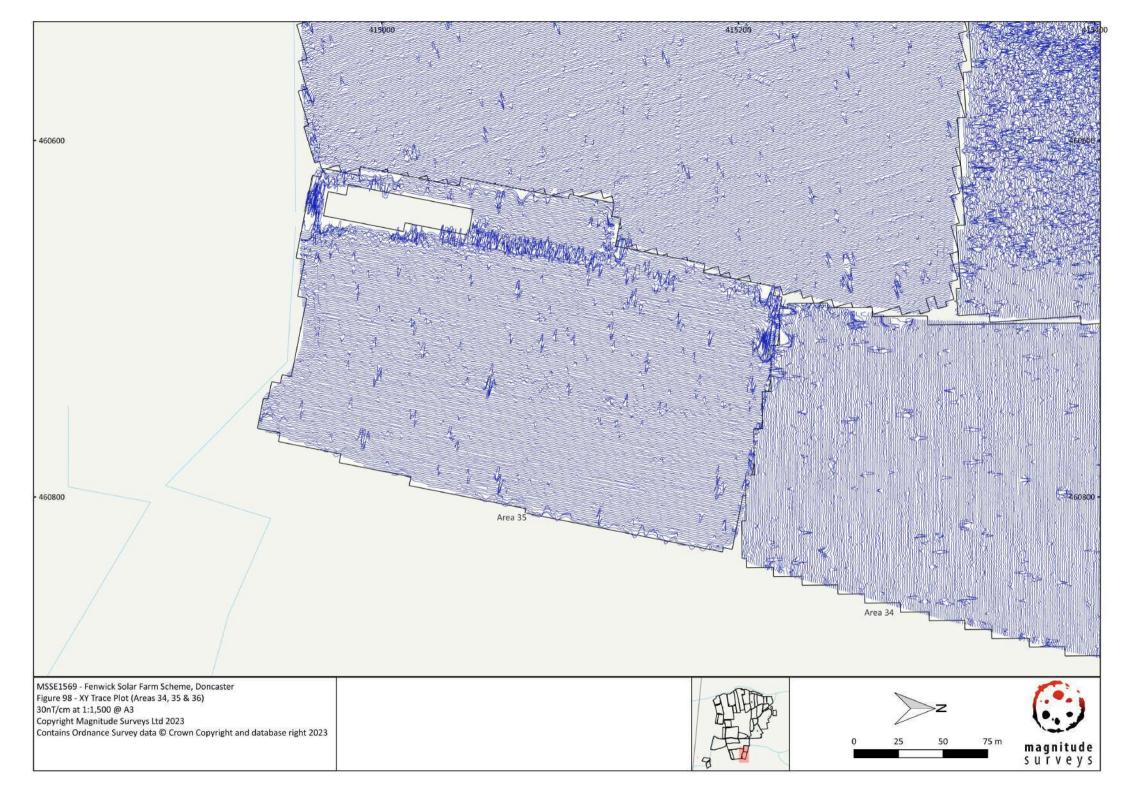


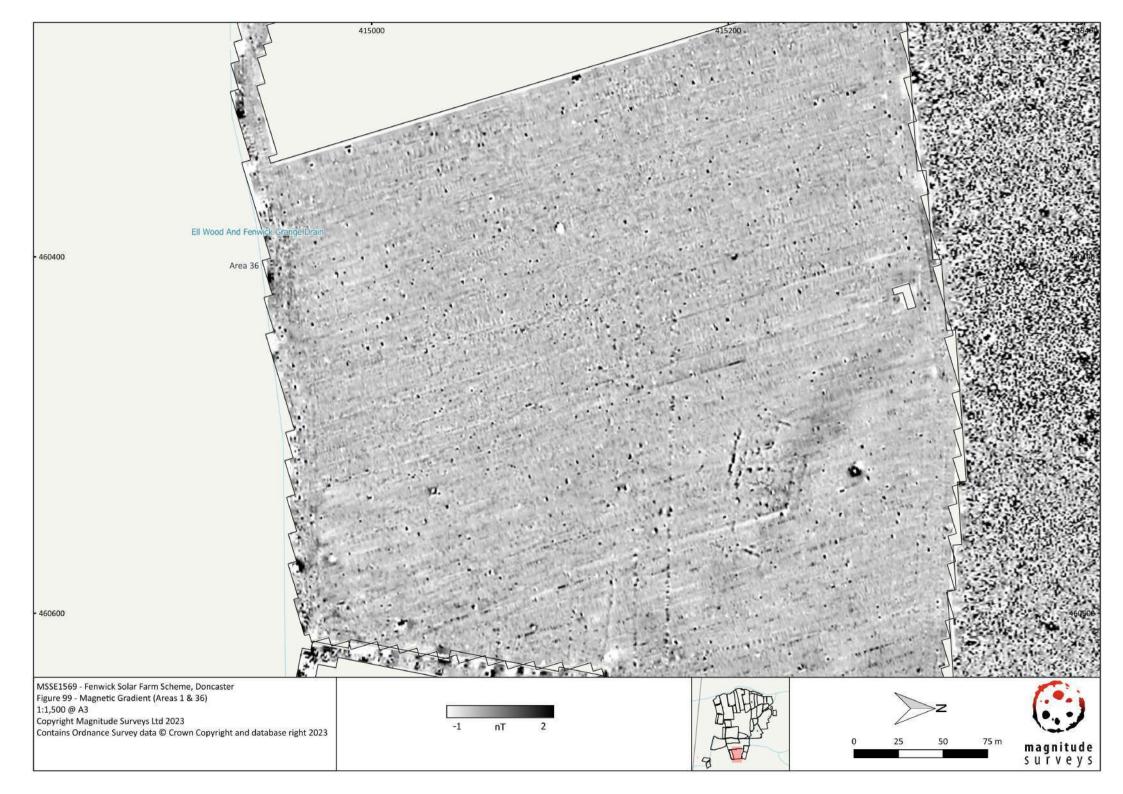


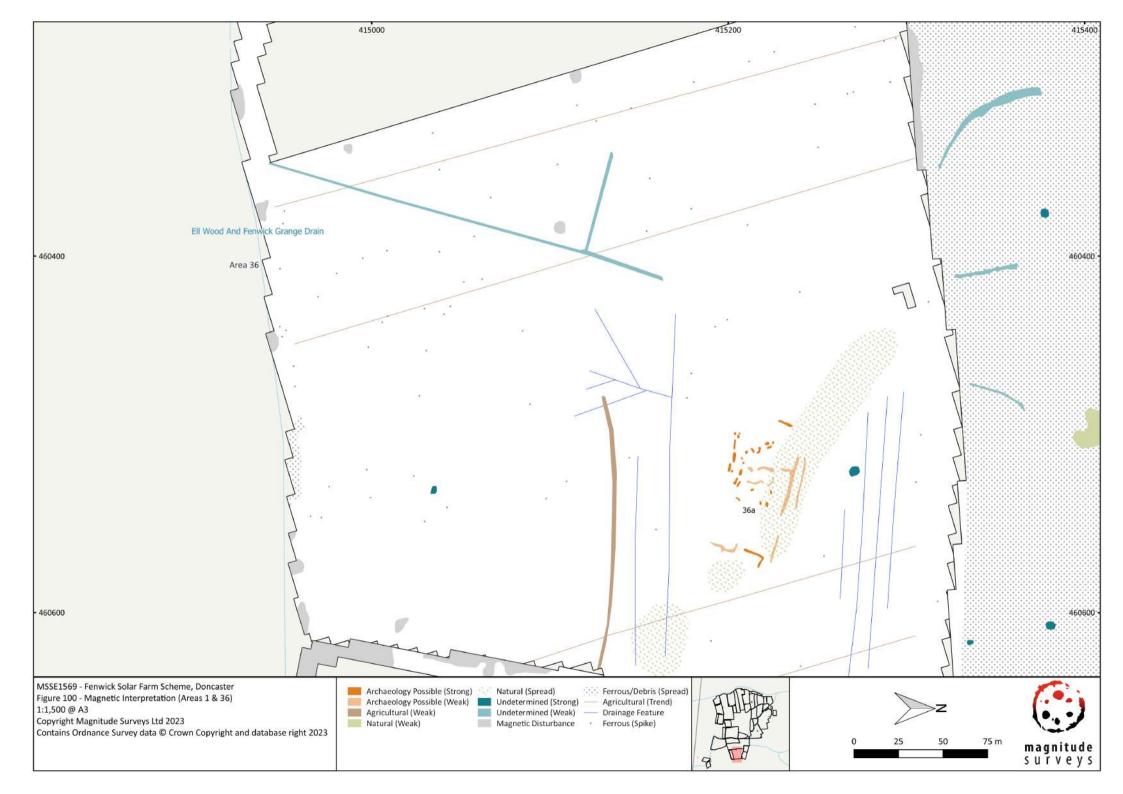


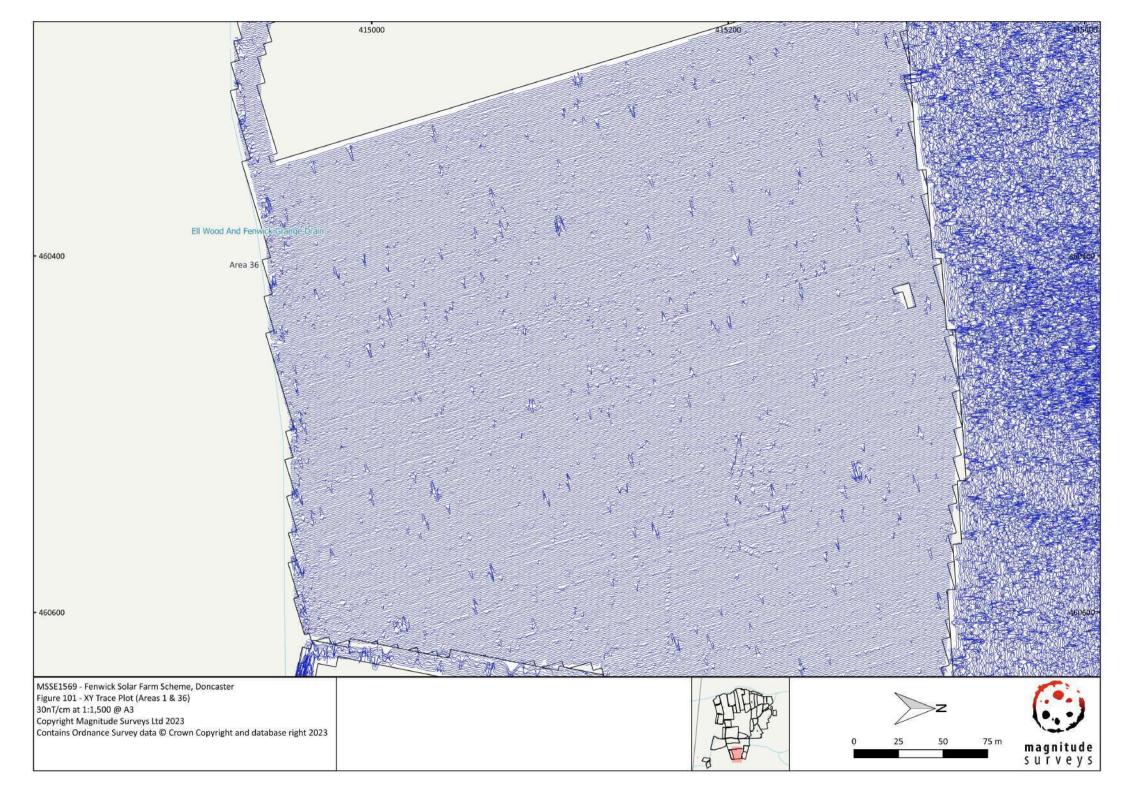




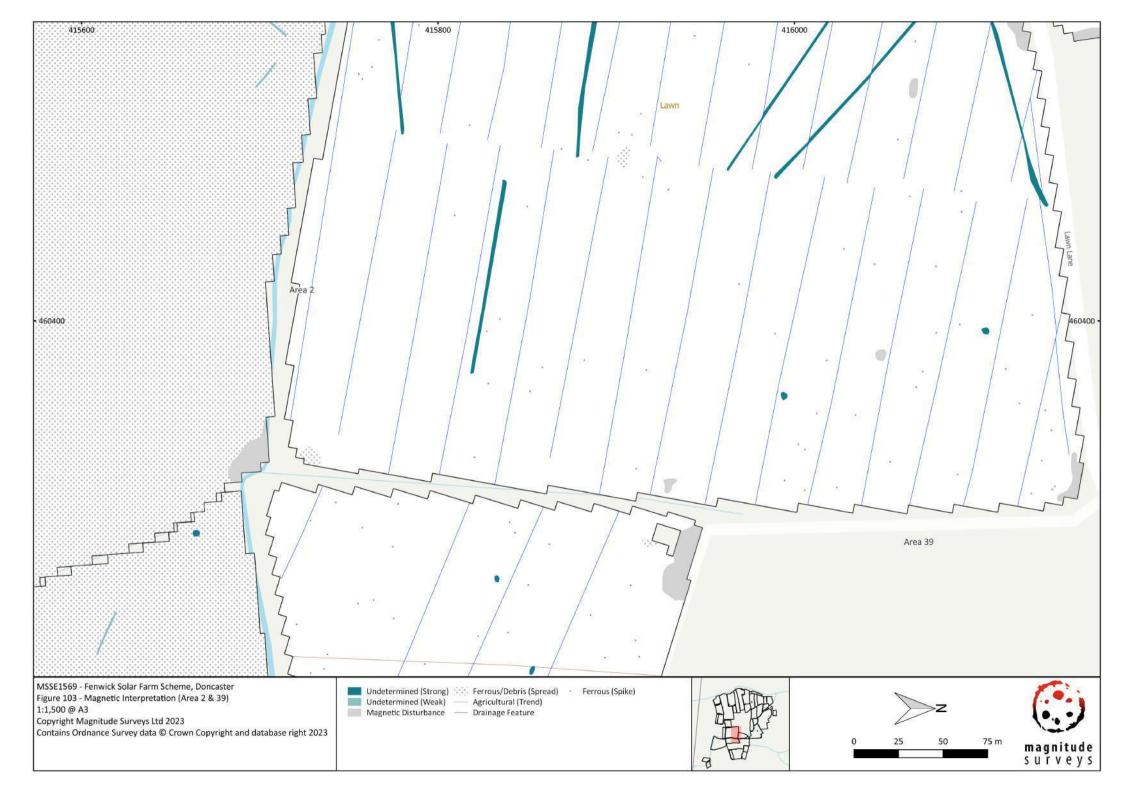


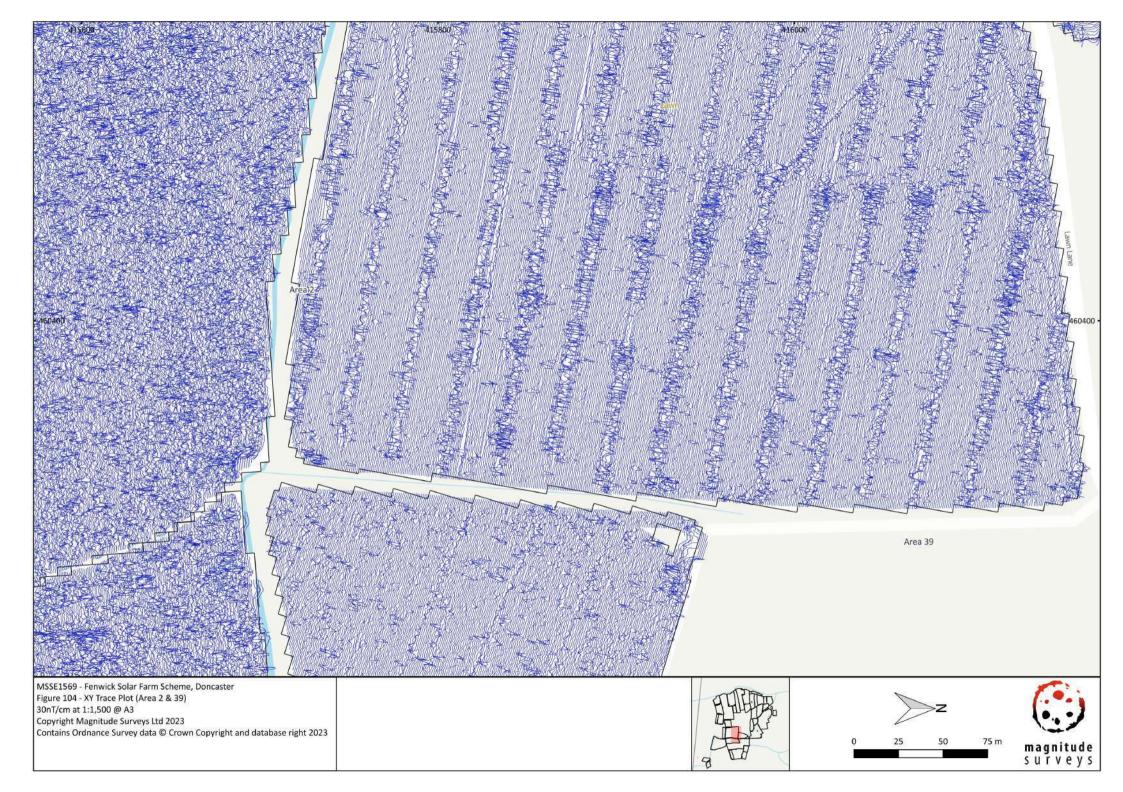


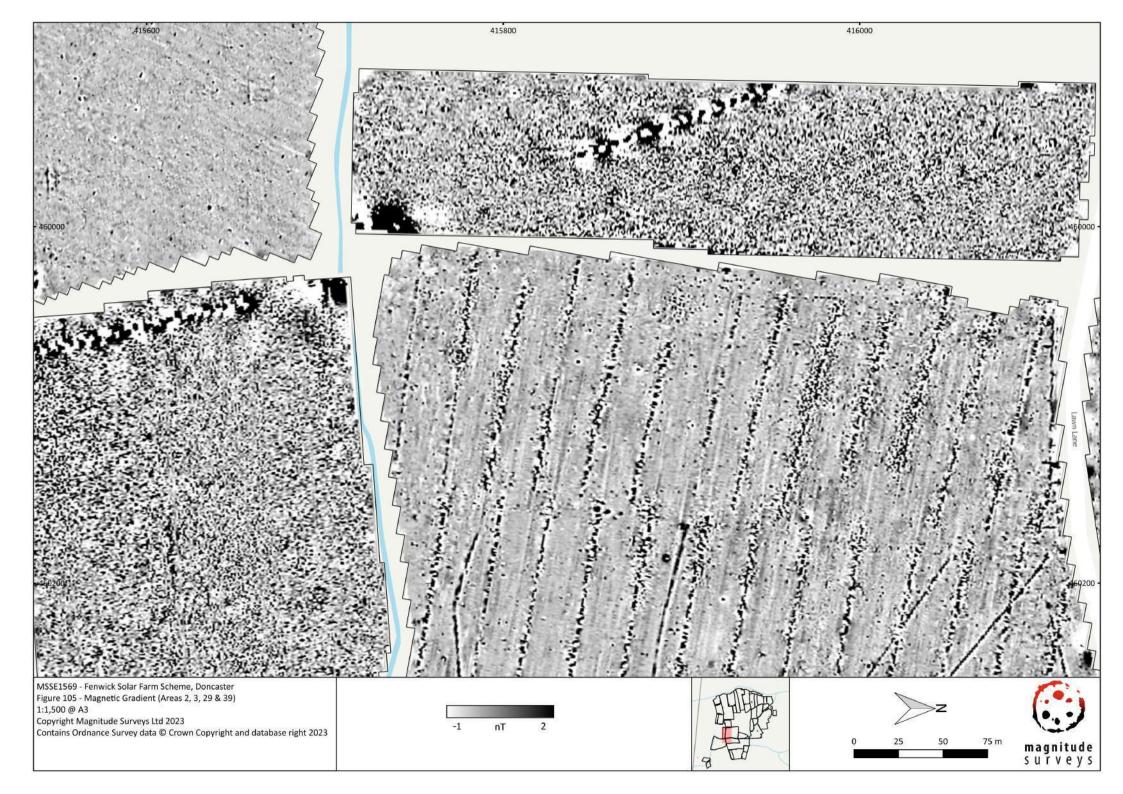


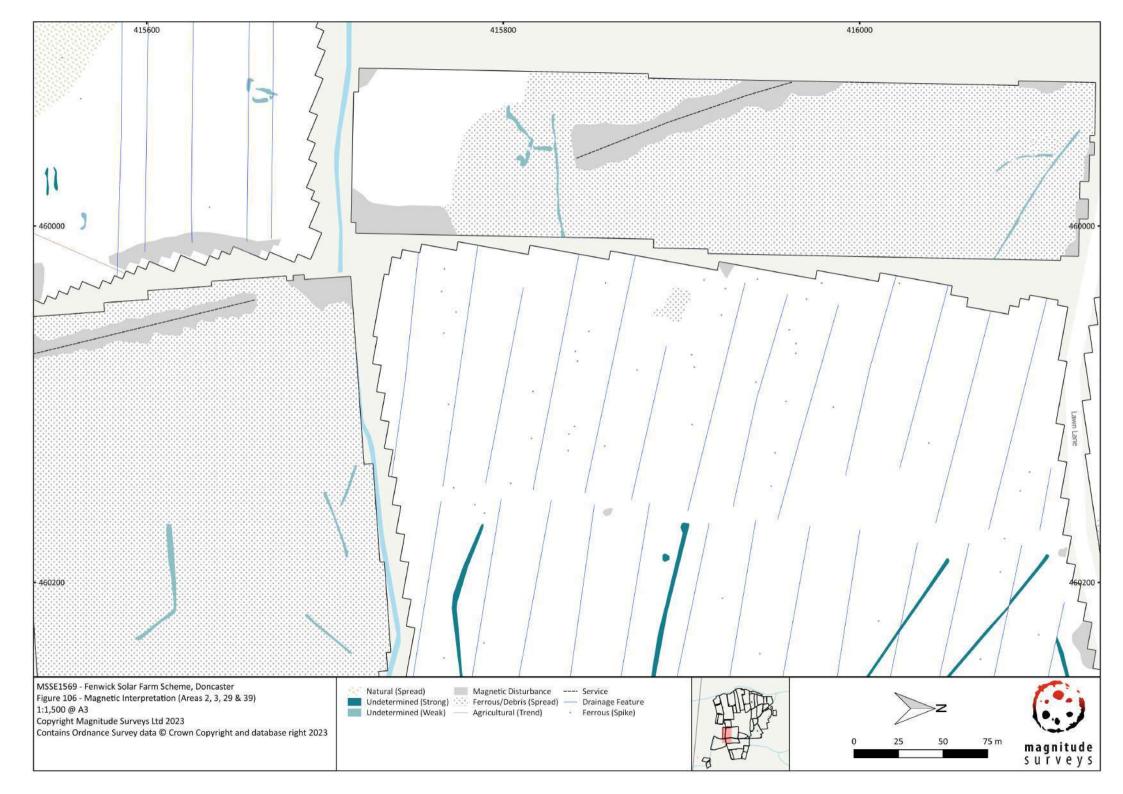


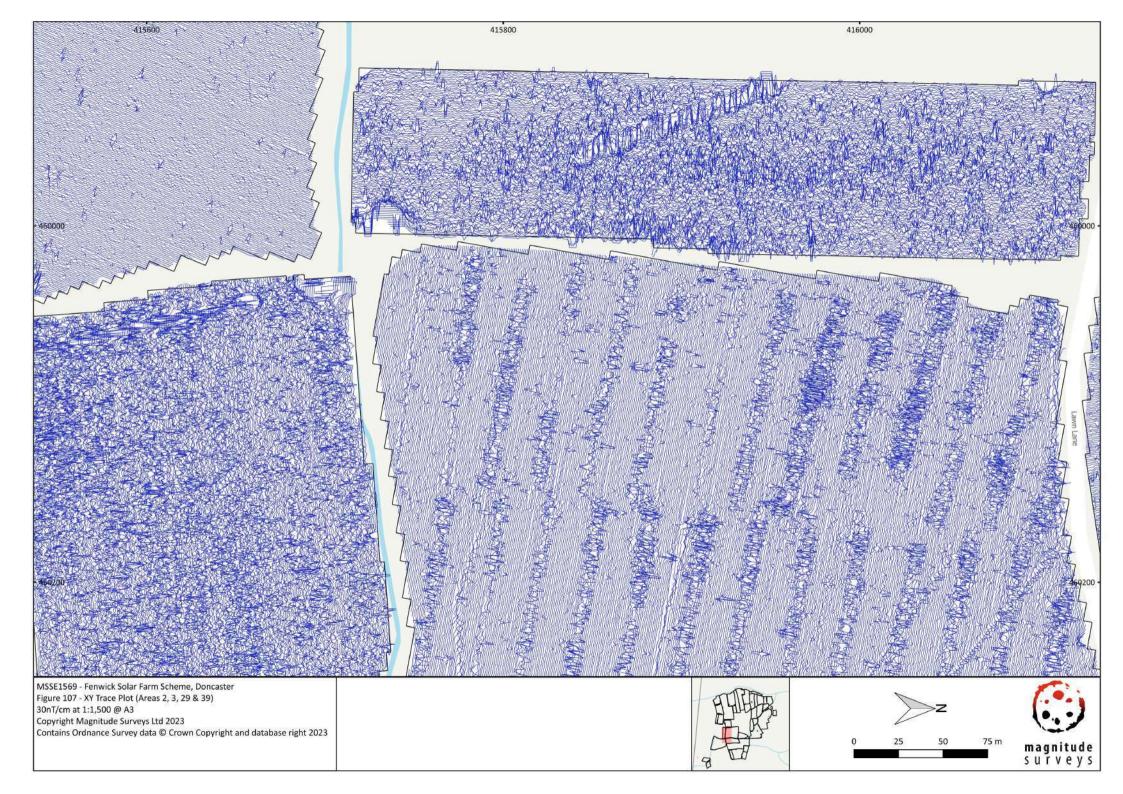


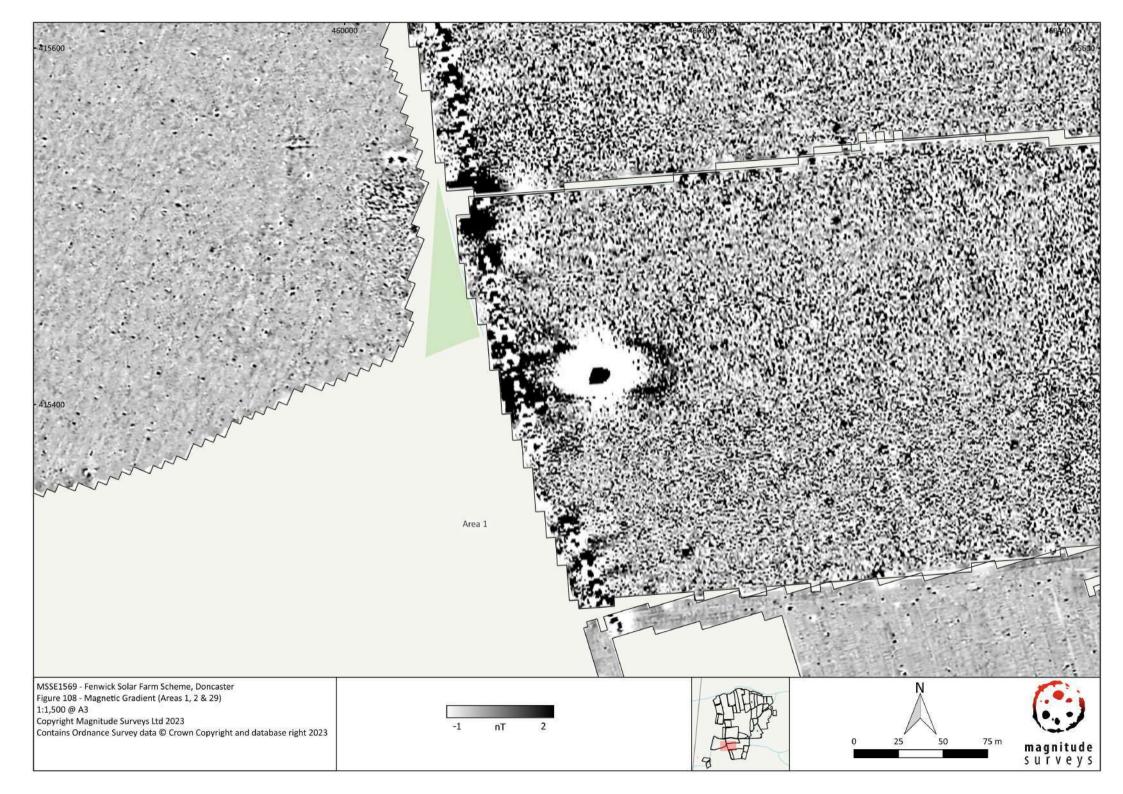


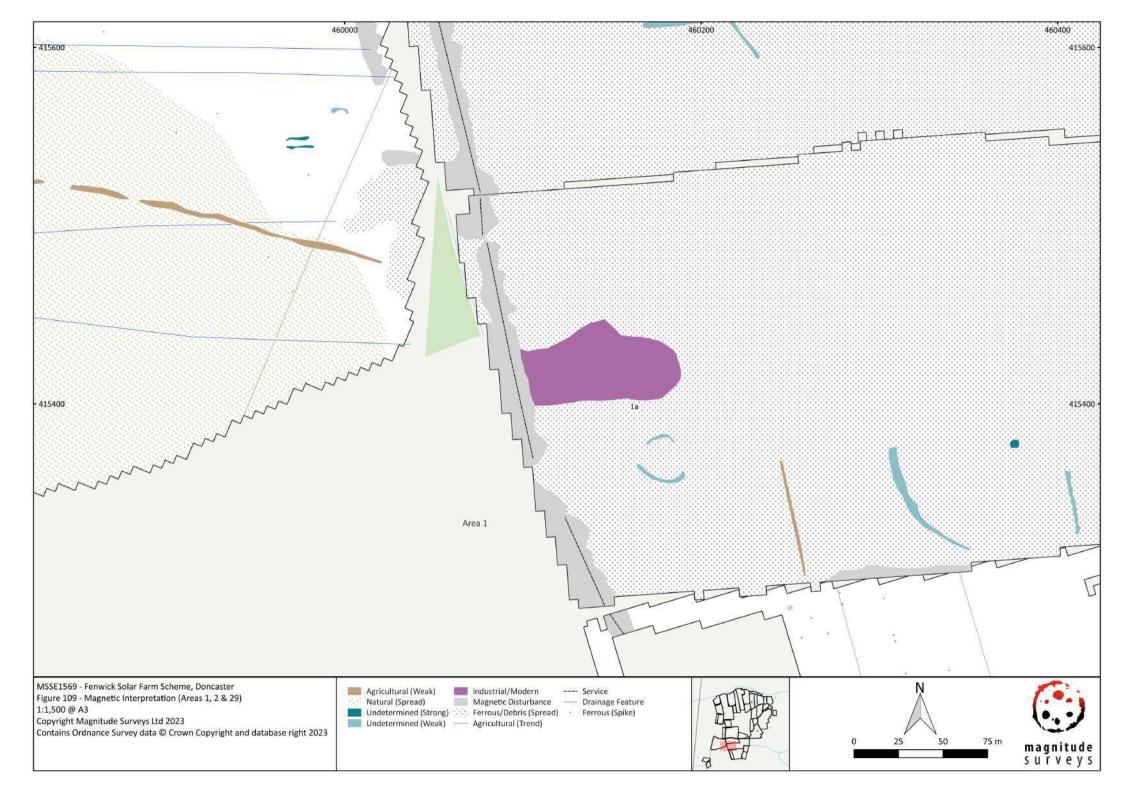


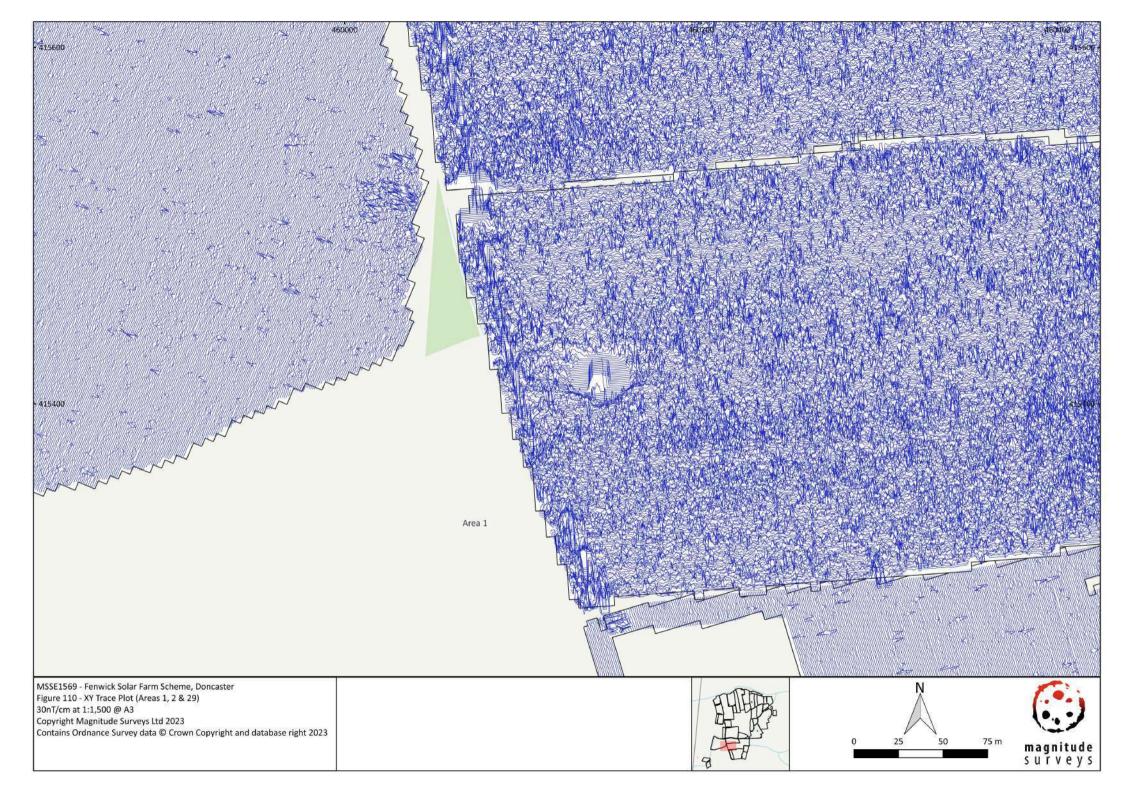


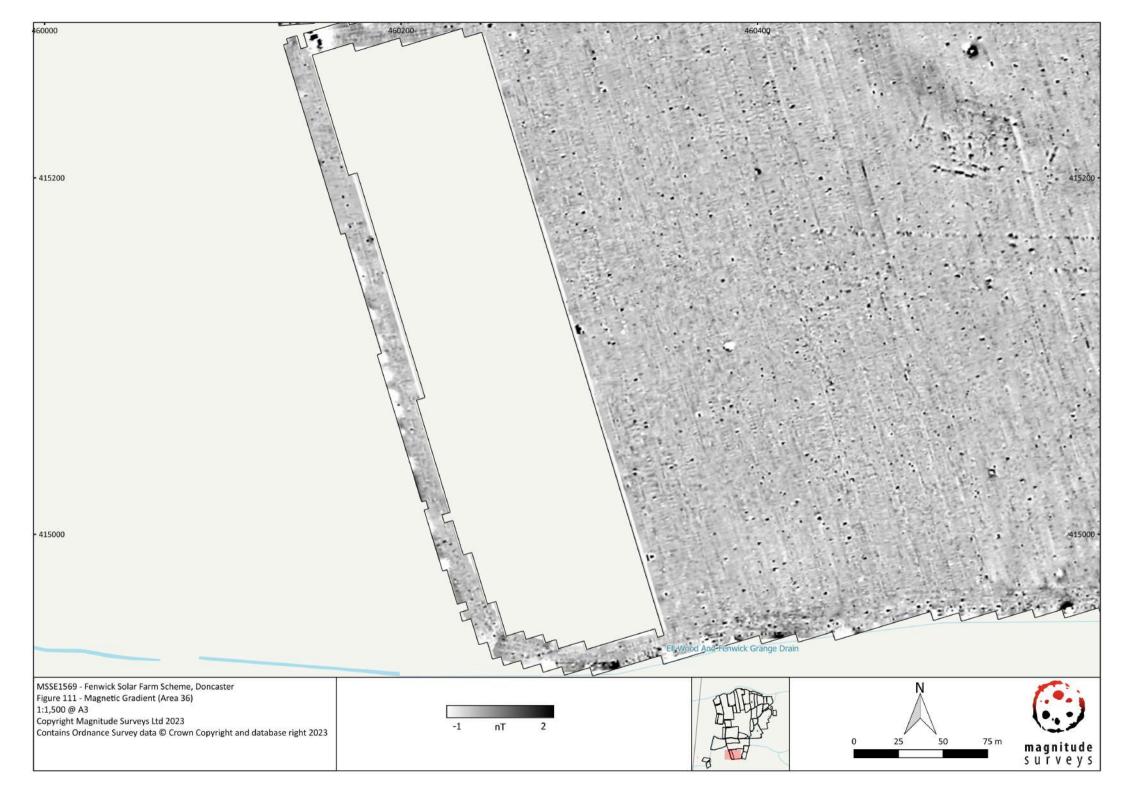


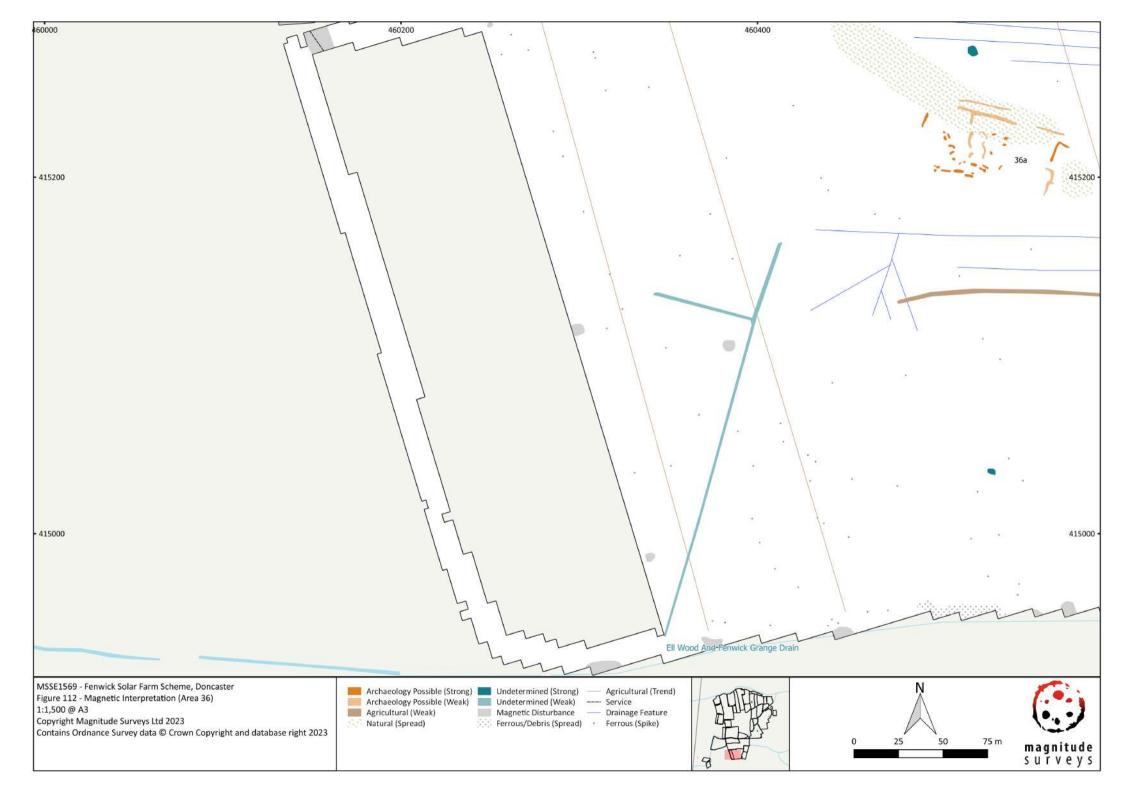


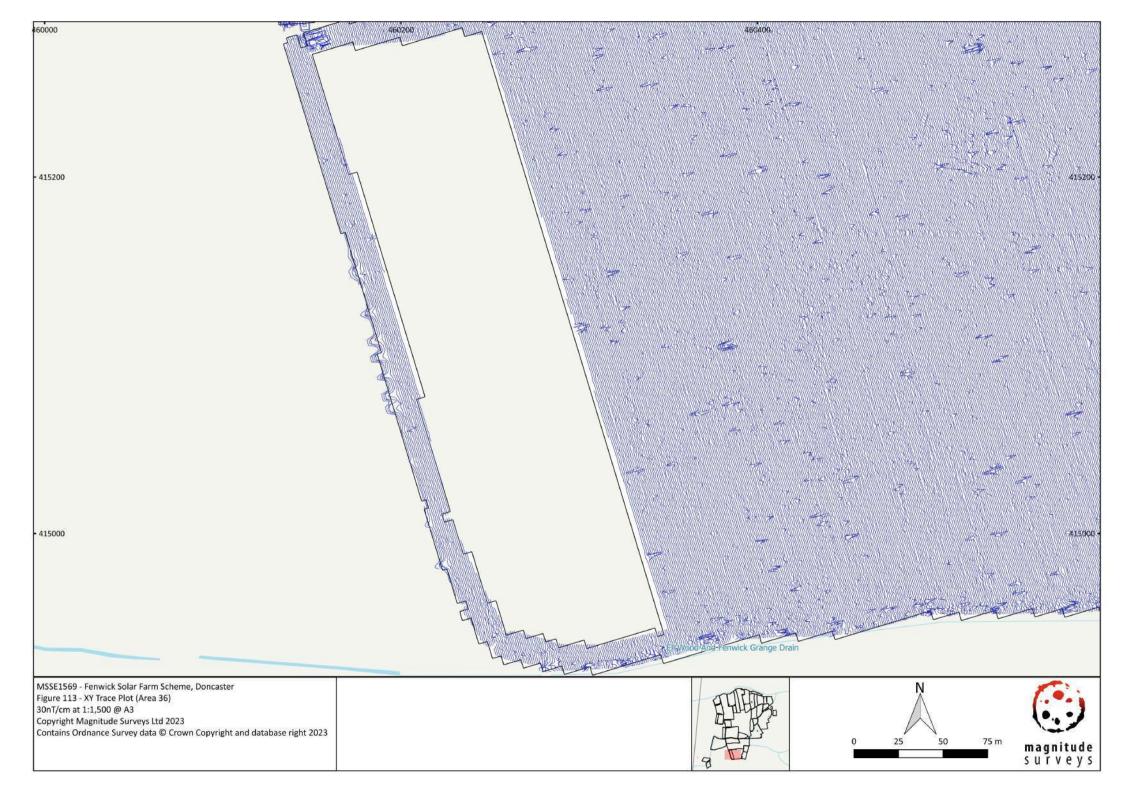


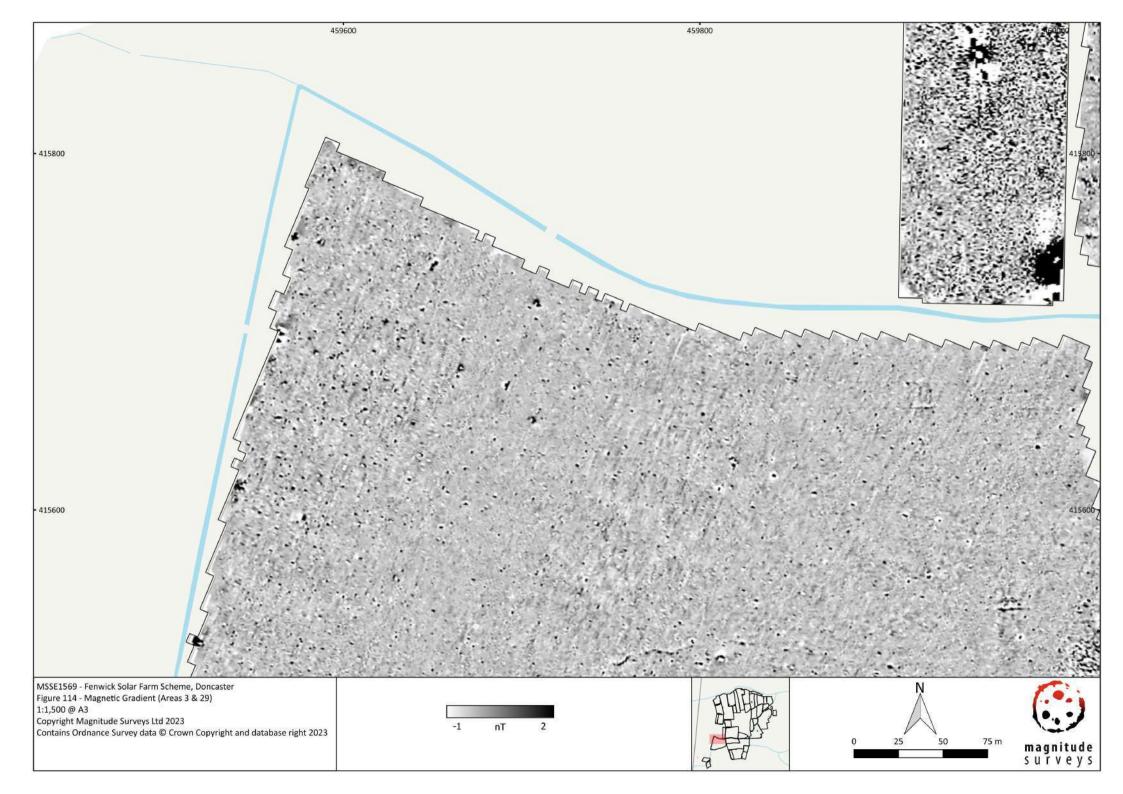


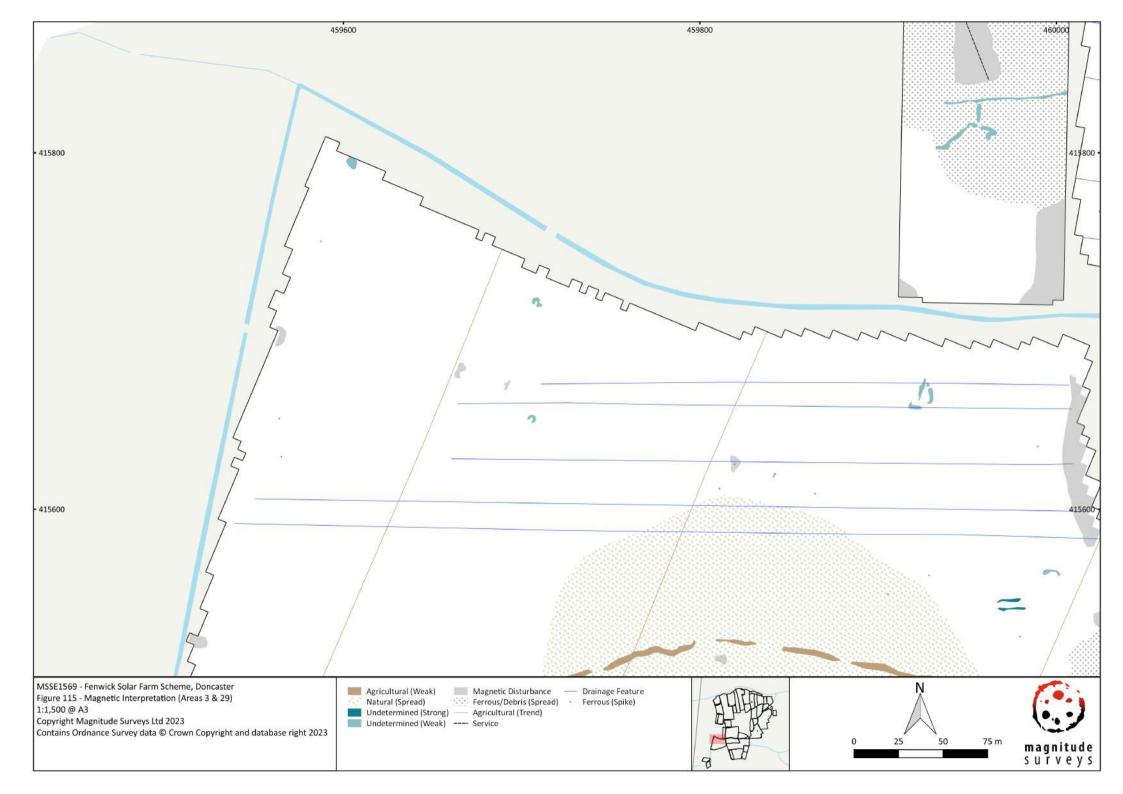


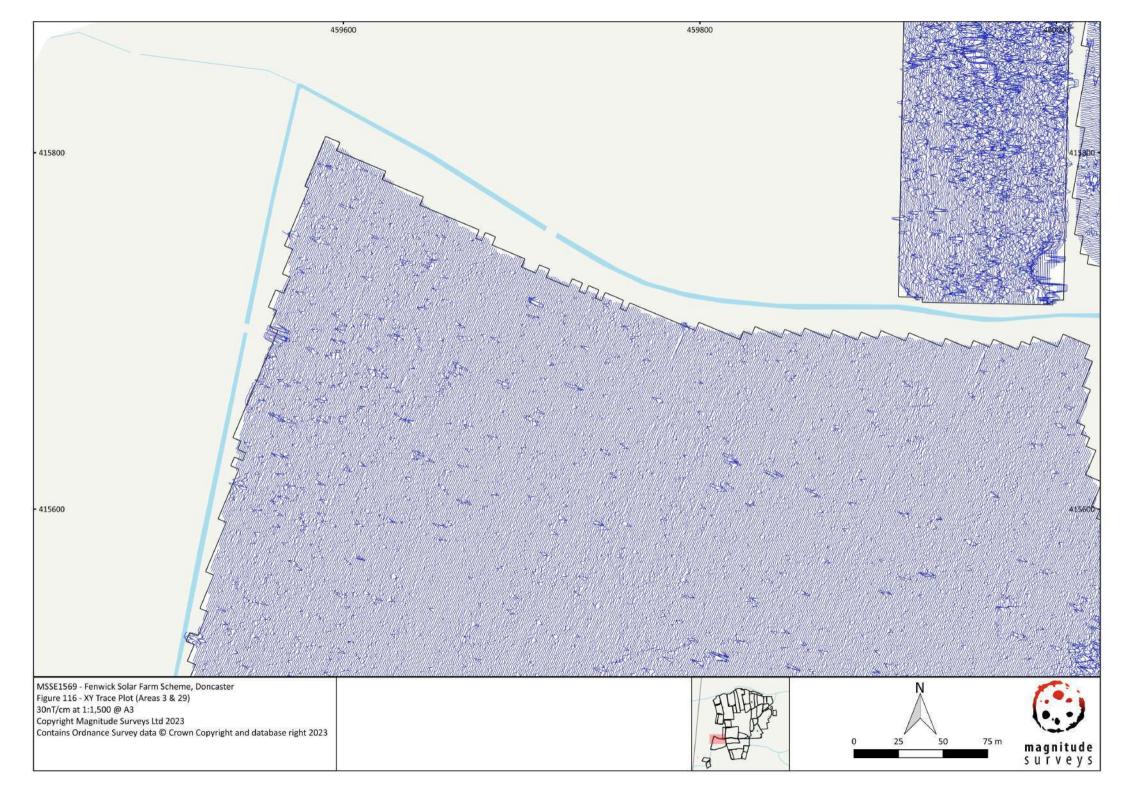


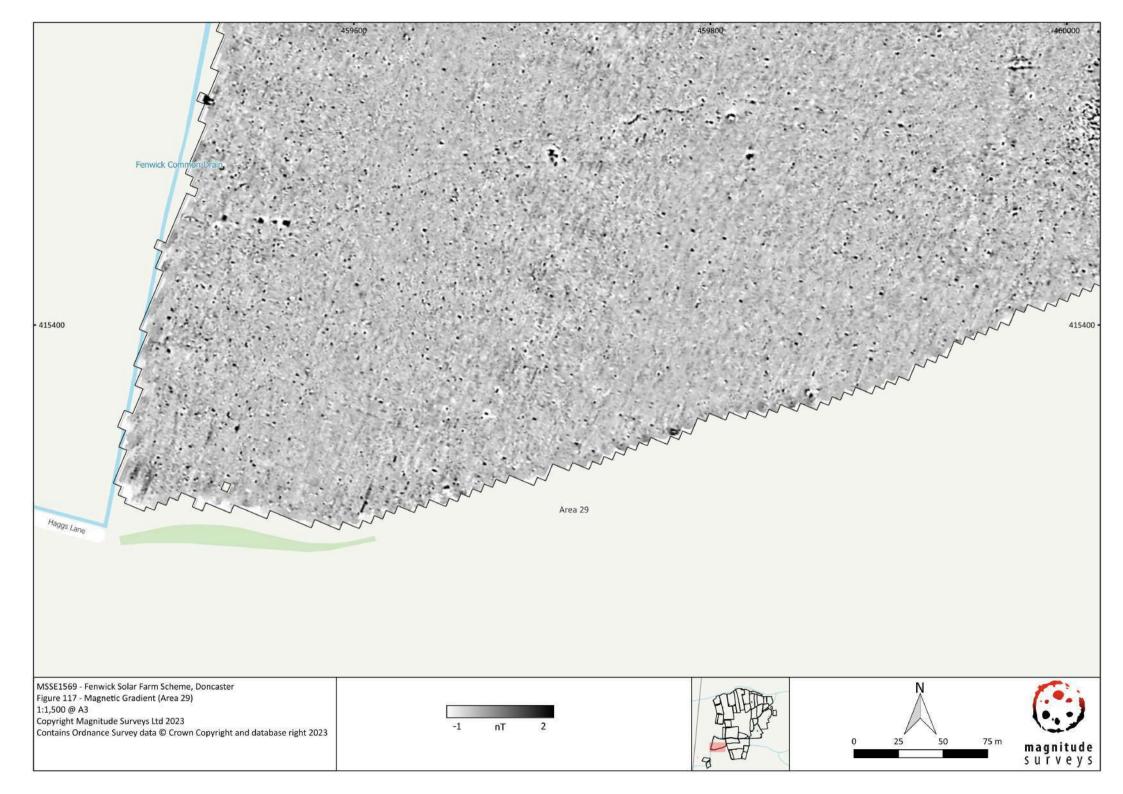


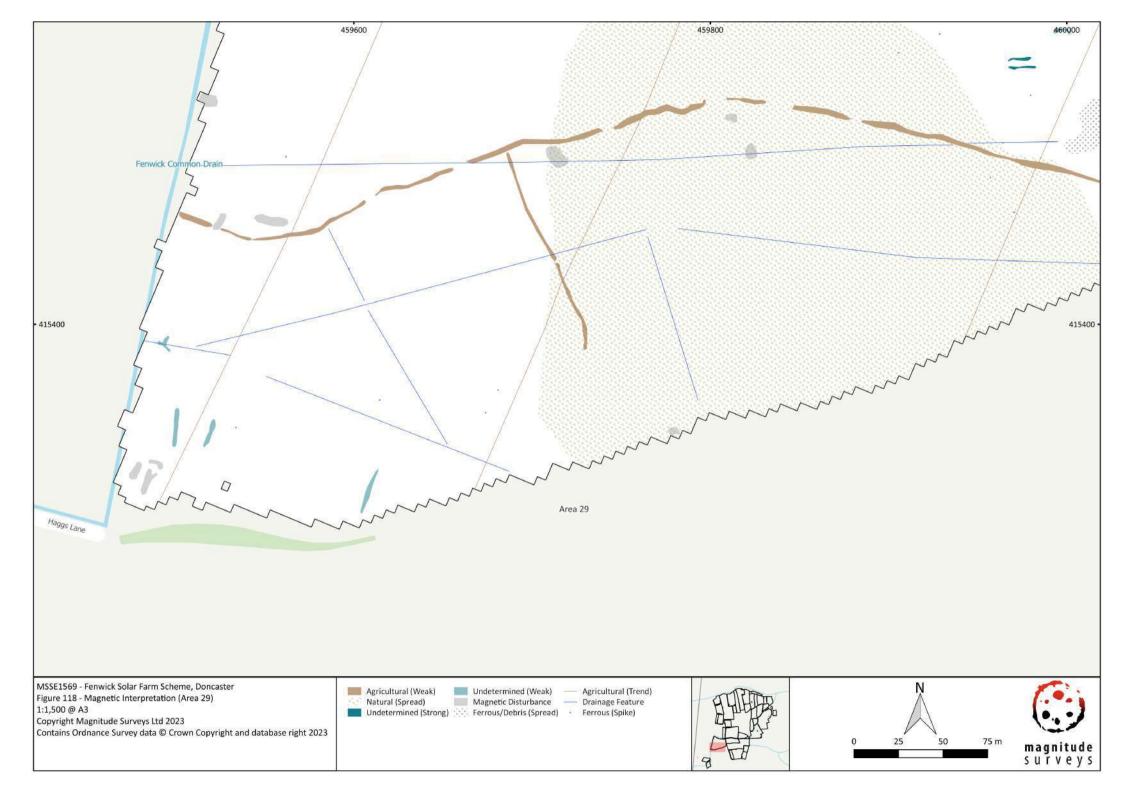


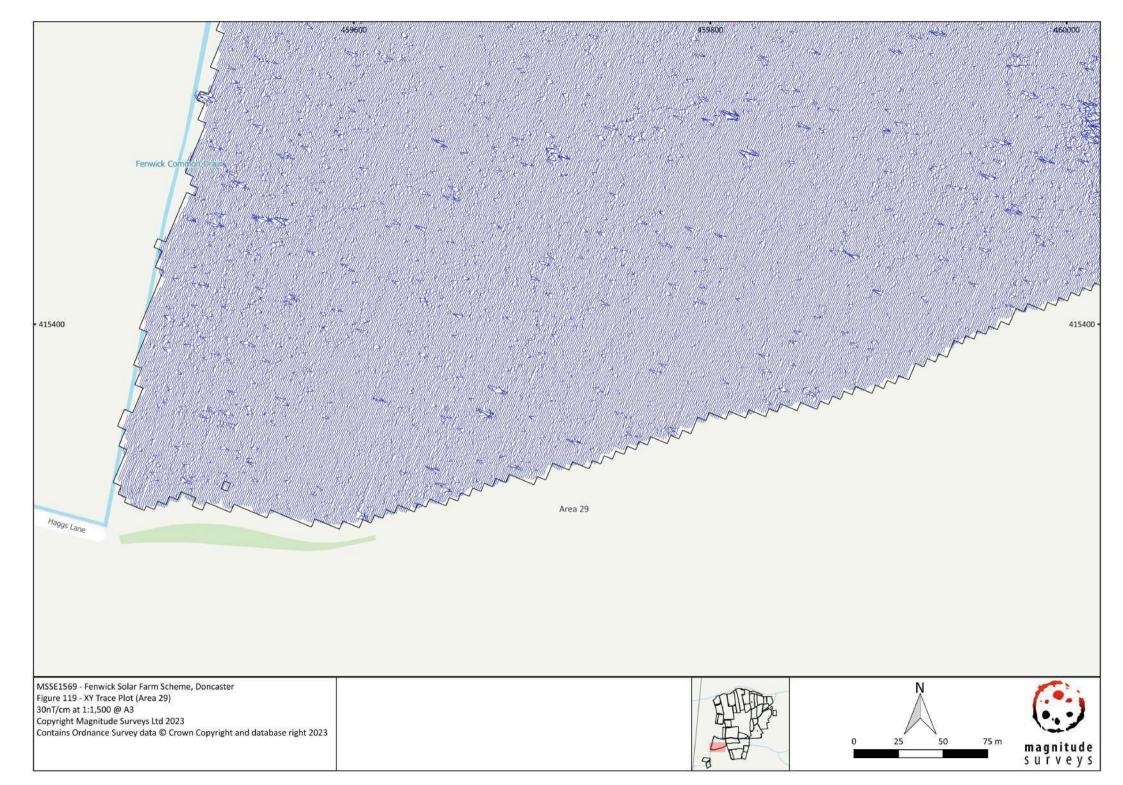


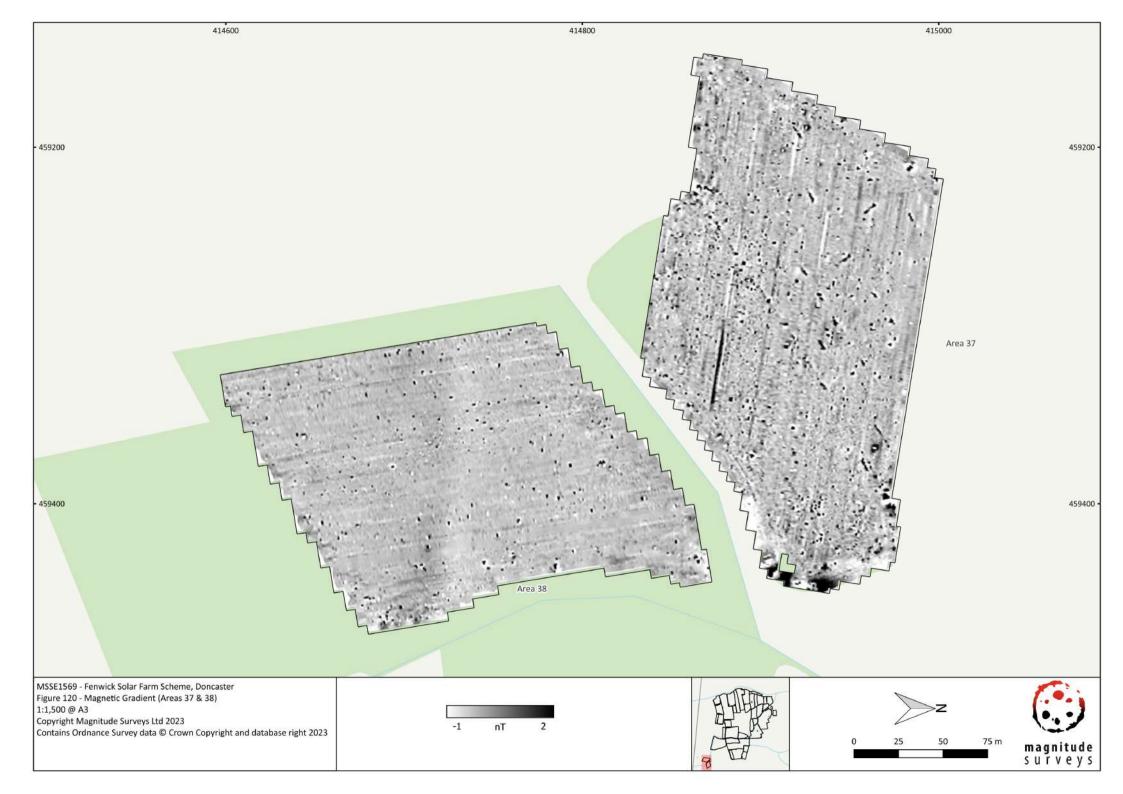


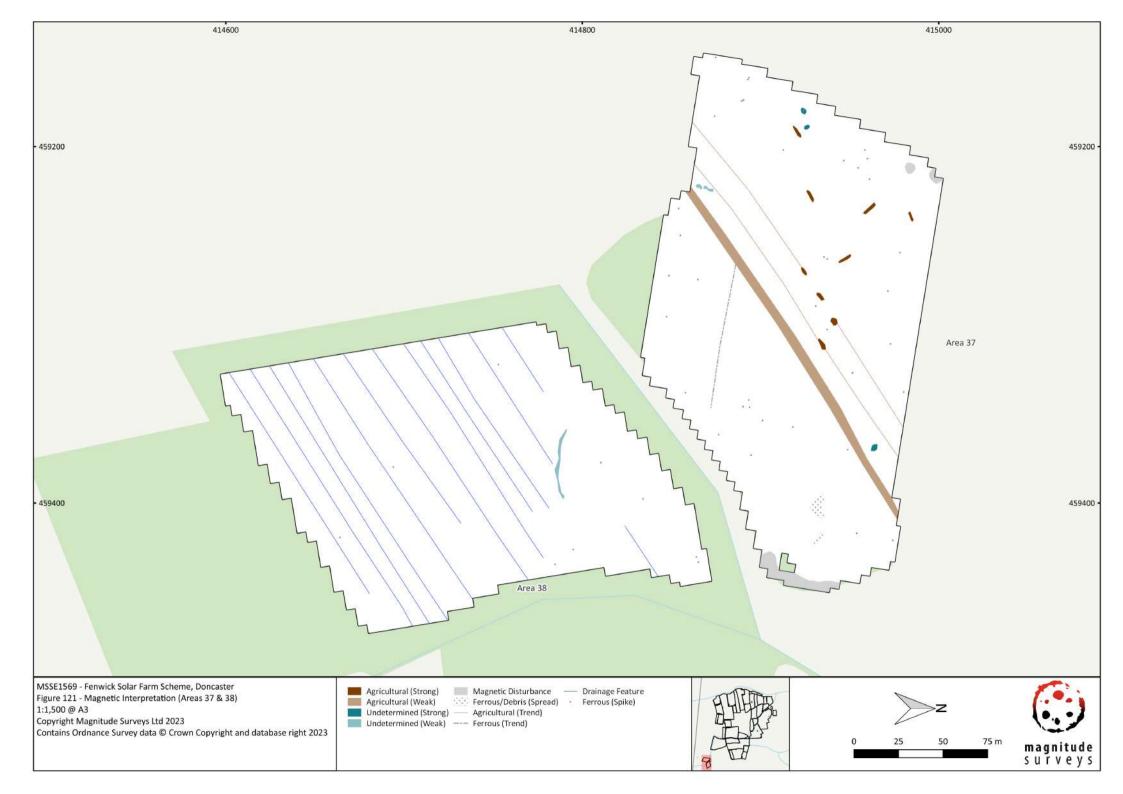


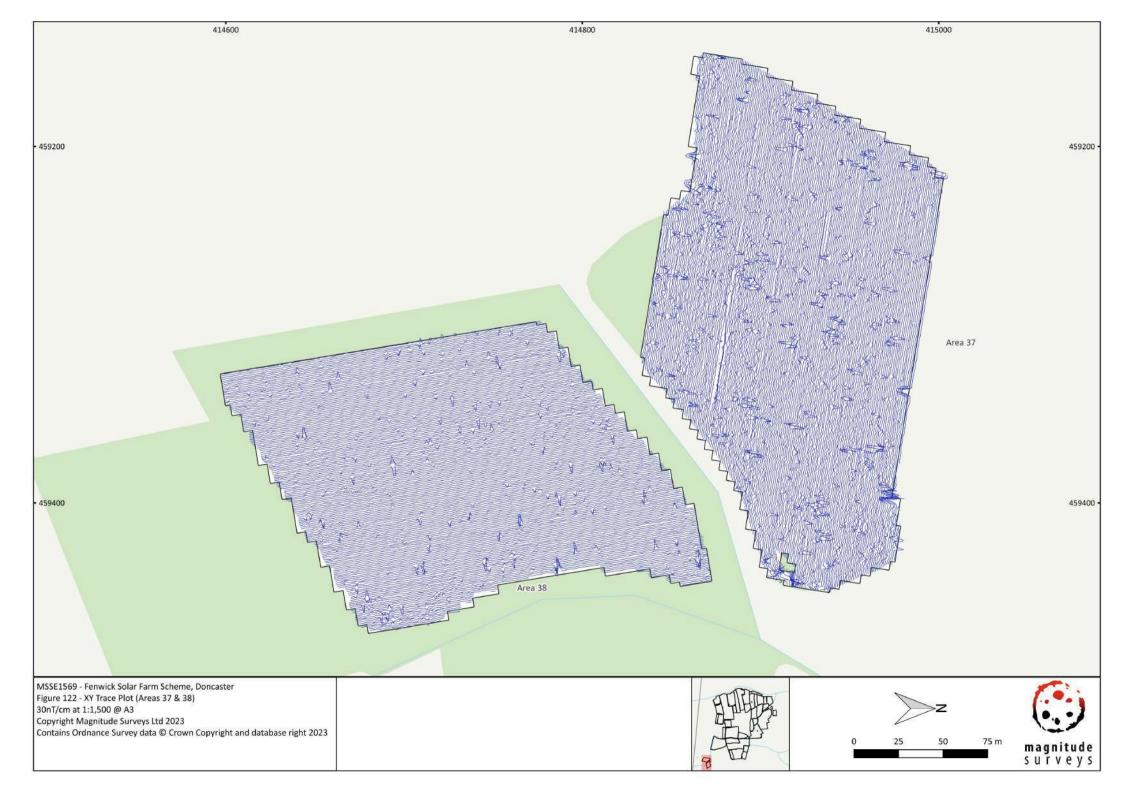














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