



**magnitude  
surveys**

**Geophysical Survey Report  
Future Chippenham Proposals:  
Reporting Zone 2**

**For  
Atkins**

**On Behalf Of  
Wiltshire Council**

**Magnitude Surveys Ref: MSST732**

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## **magnitude surveys**

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### **Abstract**

Magnitude Ltd was commissioned to locate and assess the potential for sub-surface archaeological remains of a c. 53ha area within Zone 2 of the Future Chippenham Road Proposal to the south east of Chippenham, Wiltshire. A fluxgate gradiometer survey was successfully completed across the majority of the survey area with the exception of a c. 5.6ha area not being surveyed due to waterlogged ground conditions and overgrown vegetation. Archaeological activity has been identified in the form of linear, curvilinear, and discrete anomalies forming probable and possible ditched enclosures, pits and trackways. Agricultural activity has been identified in the form of ridge and furrow cultivation, former field boundaries, modern ploughing, field drains and trackways. The survey has also identified the remnants of a towing path and related canal infrastructure. Anomalies interpreted as relating to modern activity have been identified as services and electricity pylons. The results show limited interference from overhead cables and modern ferrous material such as extant field boundaries.

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## 1. Introduction

- 1.1. Magnitude Surveys Ltd (MS) was commissioned by Atkins on behalf of Wiltshire Council to undertake a geophysical survey across Zone 2 of the Future Chippenham Planning Road, a c. 43ha area of land southeast of Chippenham, Wiltshire, and an additional 10ha spans the border between Zone 1 and 2. Zone 2 has a grid reference of ST 9403 7190 to the north, and ST 9248 7081 to the south.
- 1.2. The geophysical survey comprised hand-pulled, cart-mounted and hand-carried GNSS-positioned fluxgate gradiometer survey. Magnetic survey is the standard primary geophysical method for archaeological applications in the UK for 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 earth houses, and industrial activity (David *et al.*, 2008).
- 1.3. The survey was conducted in line with the current best practice guidelines produced by:
  - Schmidt, A. and Ernenwein, E. Guide to good practice: geophysical data in archaeology (Schmidt *et al.*, 2015)
  - David, A., Linford, N., Linford, P. and Martin, L. Geophysical survey in archaeological field evaluation: research and professional services guidelines (David *et al.*, 2008).
  - Chartered Institute for Archaeologists. Standards and guidance for archaeological geophysical survey (CIfA, 2020).
- 1.4. The survey was conducted in line with a WSI produced by MS (Swinbank, 2020).
- 1.5. The survey commenced on 28 September 2020 and took 11 days to complete.

## 2. Quality Assurance

- 2.1. Magnitude Surveys is a Registered Organisation of the Chartered Institute for Archaeologists (CIfA), the chartered UK body for archaeologists, and a corporate member of ISAP (International Society of Archaeological Prospection).
- 2.2. 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 primary aim of all archaeological geophysical survey is to identify and record potential archaeological remains through the production and interpretation of geophysical data, to inform the need for, scope and method of subsequent phases of archaeological investigation and mitigation. It should be noted that while geophysical survey can aid in identifying areas of archaeological potential, only intrusive evaluations can provide confirmation of the nature, character, extent and significance of sub-surface archaeological remains.
- 3.2. The results of all geophysical survey will be assessed and interpreted to attempt to understand the potential for buried remains within the targeted areas, in advance of development works.
- 3.3. The specific aims are to:
- Locate potential sub-surface archaeological remains within the Site and characterise where possible.
  - Produce a comprehensive report and archive.
  - Inform a programme of potential trial trench evaluation.

### 4. Geographic Background

- 4.1. Zone 2 was located c.2 km southeast of Chippenham, Wiltshire (Figure 1). Magnetic Gradiometer survey was undertaken across 5 fields under arable, and 22 fields under pasture conditions based around Lower Lodge Farm, Middle Lodge Farm and Forest Farm. The A4 forms the northern and eastern boundary of Zone 2, to the west and south the survey area is bounded by further agricultural land (Figure 2). To the east a c. 5.6 ha area was not surveyed due to waterlogged conditions and overgrown vegetation.
- 4.2. Survey considerations:

| Survey Area | Ground Conditions                                                                             | Further Notes                                                                                                                                                                                   |
|-------------|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1           | The survey area consisted of flat pastoral grassland.                                         | The survey area was bounded by hedges to the southwest and northeast. The field continued to the northwest and southeast.                                                                       |
| 2           | The survey area consisted of flat pastoral grassland.                                         | The survey area was bounded by hedges to the south, east and southwest. The field continued to the northwest. Overhead cables were running alongside the north-western edge of the survey area. |
| 3           | The survey area consisted of pastoral grassland. The field sloped gently from north to south. | The survey area was bounded by hedges on all sides. A metal fence was located along its south-eastern edge.                                                                                     |

|    |                                                                                                                                                                              |                                                                                                                                                                                                                             |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4  | The survey area consisted of flat pastoral grassland.                                                                                                                        | The survey area was bounded to the north, east and south by hedgerows. The field continued to the west and southeast.                                                                                                       |
| 5  | The survey area consisted of flat pastoral grassland.                                                                                                                        | The survey area was bounded to the north by hedgerow and a road, and to the south and east by hedgerows. The field continued to the west.                                                                                   |
| 6  | The area consisted of flat pastoral grassland.                                                                                                                               | The area was bounded to the north by a hedgerow and a road, and to the south and west by hedgerows. The field continued to the east.                                                                                        |
| 7  | The survey area consisted of flat pastoral grassland.                                                                                                                        | The area was bounded by hedges on all sides. Remnants of ridge and furrow regimes were visible within the survey area.                                                                                                      |
| 8  | The survey area consisted of pastoral grassland. The field sloped gently from north to south.                                                                                | The survey area was bounded by hedges to the north, south and east and a metal fence to the east. A feeding trough was located in the centre of the field.                                                                  |
| 9  | The survey area consisted of pastoral grassland. The field sloped gently from north to south.                                                                                | The survey area was bounded by a hedge to the south, a track to the west and a wire fence to the north and east.                                                                                                            |
| 10 | The survey area consisted of pastoral grassland. The field sloped gently from north to south.                                                                                | The survey area was bounded by a track to the east, farm buildings to the north and a hedge to the west and south.                                                                                                          |
| 11 | The survey area consisted of flat pastoral grassland.                                                                                                                        | The survey area was bounded by a wire fence to the north and hedgerows to the east and west. The field continued to the south. Farm equipment was located in the north of the survey area.                                  |
| 12 | The survey area consisted of flat pastoral grassland.                                                                                                                        | The survey area was bounded by a hedge to the west, and a wire fence to the east. The field continued to the north and south. A feeding trough was located in the south-western corner.                                     |
| 13 | The survey area consisted of a pastoral grassland. The field sloped down from north to south.                                                                                | The survey area was bounded by hedges on all sides. Overhead cables crossed the survey area in a southwest-northeast direction.                                                                                             |
| 14 | The survey area consisted of a flat arable field with young crop.                                                                                                            | The survey was bounded by a wire fence to the north, west and south. The field continued further to the east.                                                                                                               |
| 15 | The survey area consisted of an arable field gently sloping from north to south. The north-eastern corner of the survey area was not surveyed due to waterlogged conditions. | The survey area was bounded by a hedge and a wire fence to the east, west and south. The field continued to the north.                                                                                                      |
| 16 | The area consisted of flat pastoral grassland.                                                                                                                               | The area was bounded by hedges to the east, west and south. The field continued to the north. The eastern area was not surveyed due to waterlogged conditions. Overhead cables crossed the field along its northern extent. |

|    |                                                                                                                                                       |                                                                                                                                                                                                          |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 17 | The area consisted of flat pastoral grassland. The northern part of the survey area could not be surveyed due to overgrown vegetation.                | The area was bounded by a hedge to the west and a wire fence to the north. The field continued to the south and east.                                                                                    |
| 18 | The area consisted of flat pastoral grassland. The northern part of the survey area could not be surveyed due to overgrown vegetation .               | The area was bounded by a hedge to the east and a wire fence to the north. The field continued to the south and east.                                                                                    |
| 19 | The survey area consisted of flat arable field with young wheat crop.                                                                                 | The survey area was bounded by a wire fence to the north and west. The field continued to the southeast. An overhead cable was running alongside its south-eastern boundary.                             |
| 20 | The survey area consisted of flat arable field with young wheat crop. The field was not surveyed to the east and south due to waterlogged conditions. | The survey area was bounded by a hedge to the east, west, north and south. Overhead cables were crossing the field through its south-eastern corner.                                                     |
| 21 | The survey area consisted of flat pastoral grassland.                                                                                                 | The survey area was bounded by a wire fence to the west and north and a hedge to the east. The field continued further to the south. A telegraph line crosses the survey area in an east west direction. |
| 22 | The area consisted of a flat harvested maize field.                                                                                                   | The area was bounded by hedges to the east and north, and a wire fence to the south. The field continued to the east.                                                                                    |
| 23 | The survey area consisted of pastoral grassland, sloping down from the centre to the north and south.                                                 | The survey area was bounded by a metal fence and a hedge to the north and south. The field continued to the east and west.                                                                               |
| 24 | The survey area consisted of pastoral grassland sloping downwards from northeast to southwest.                                                        | The survey area was bounded by a hedge to the west and north and an electric fence to the south and east.                                                                                                |
| 25 | The survey area consisted of pastoral grassland sloping downwards from northeast to southwest.                                                        | The survey area was bounded by a hedge to the north and an electric fence to the west, south and east.                                                                                                   |
| 26 | The survey area consisted of flat pastoral grassland.                                                                                                 | The survey area was bounded by a wire fence to the west and hedges to the east, north and south.                                                                                                         |
| 27 | The survey area consisted of pastoral grassland sloping gently from west to east.                                                                     | The survey area was bounded by a metal fence to the east, west and south. The field continued to the north.                                                                                              |

- 4.3. The underlying geology comprises mainly mudstone of the Oxford Clay Formation in Areas 1 to 27 with sandstone, siltstone and mudstone of the Kellaways Formation recorded in Areas, 3, 7, 13, 14, 15, 16, 17, 18, 19 and 20. Superficial deposits of alluvial fan comprising of clay and silt, and river terrace deposits of clay and silt, are recorded in the Areas 10 to 18. There are no superficial deposits recorded in the centre and north (British Geological Survey, 2021).

The soils within Zone 2 consist of slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (Soilscapes, 2021).

## 5. Archaeological Background

- 5.1. The following is a summary of the Cultural Heritage section of the Preliminary Environmental Assessment of Options Report produced and provided by Atkins (2020). This summarises the recorded archaeology with a 500m radius of each route option, extending to 1km where archaeological assets relevant to the assessment are recorded.
- 5.2. Prehistoric activity is recorded within Zone 1 in the form of a flint scatter containing a geometric microlith, bladelets, and fragments of flint flakes and scrapers. Two further flint findspots included a Neolithic scraper tool, and a broken polished axe. Similar flint items have been recovered within Zone 2, including Mesolithic tools and waste flakes and an arrowhead. Two Mesolithic sites are recorded within Zone 2 comprising 76 Mesolithic flint tools (MWI3649, MWI3650).
- 5.3. In Zone 4 a collared Urn is recorded which is often associated with early Bronze Age burials (MWI3657). Further two Bronze Age findspots and two sites containing Bronze Age remains have been identified within Zone 1. These include two ring ditches, and late Neolithic/ Early Bronze Age pottery and flint, as well as human remains (MWI76688 and MWI76690).
- 5.4. Iron Age activity is limited to within Zone 1, where two sites are recorded. A settlement with associated field system, and a late Iron Age/ early Romano-British crouched burial (MWI15224 and EWI6182).
- 5.5. Romano-British activity is recorded within Zones 1 and 2. Zone 1 contains field-systems, a settlement and associated pottery deposits (MWI5224 and MWI5226). Within this settlement area, located c.300m north of the western end of Zone 1, a trackway, a well, a drying oven, brooches, and a coin of Domitian have been excavated. The type of drying oven is typically associated with a farmstead or villa type structures (EWI618). A second settlement within Zone 1 identified as an area of occupation, and further systems of field boundaries and enclosures is located south of the survey area (EWI6543). Within Zone 2 a Romano-British ladder-enclosure, as well as curvilinear features were identified through geophysical survey. Excavations uncovered a droveway and field systems, and a large sub-circular enclosure (EWI8027 and MWI66322).
- 5.6. No Anglo-Saxon remains are recorded within any of the Zones. However, Chippenham is recorded to have been a Saxon Royal Estate. Though in the 9th century the site formed part of the forest belt known as 'Sealwudu'.
- 5.7. During the medieval period the route options fall largely within the bounds of the Royal Forest of Chippenham which included a mixture of arable, meadow, pasture and woodland. The south of Zone 2 is recorded as being a medieval deer park, a pair of parallel tracks from this deer park extended into the south of Zone 1 (MWI5236). Within Zone 1 there are a number of LiDAR and aerial survey results identifying non-designated earthworks and cropmarks, likely relating to settlements associated with trackways, field systems and enclosures. Geophysical survey and excavation have identified deserted settlements within Zone 1 (MWI74030). At least eight

blocks of medieval ridge and furrow earthworks are recorded within Zone 1 often associated with medieval settlement activity, field systems and boundaries. Across Zone 3 and extending into Zone 4 wartime aerial photographs, LiDAR and geophysical surveys have identified extensive ridge and furrow cultivation. These are associated with slight earthworks of a deserted settlement, with hollow ways and traces of house platforms (MWI74026).

5.8. Post medieval activity largely relates to agricultural activity, including field boundaries in Zone 1, post medieval ridge and furrow cultivation, demolished farms in Zone 2, and water meadows in Zone 3, along with fishponds and ditches (NHLE1022430).

5.9. WWII pill boxes are recorded in Zones 1 and 2, a total of 21 fall within the 500m radius of the route options (MWI31747).

## 6. Methodology

6.1. 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. Data Collection

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

6.2.2. Table of survey strategies:

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

6.2.3. The magnetic data were collected using MS' bespoke hand-pulled cart system OR hand-carried GNSS-positioned system.

6.2.3.1. MS' cart OR 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.

6.2.3.2. 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.

**6.2.3.3.** 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.

## 6.3.Data Processing

6.3.1. 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.

## 6.4.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 plot (Figure 9, 12 & 15). XY trace plots visualise the magnitude and form of the geophysical response, aiding in 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, historic maps, LiDAR data, and soil and geology maps. Google Earth (2021) was consulted as well, to compare the results with recent land usages.

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.

## 7. Results

### 7.1. Qualification

7.1.1. Geophysical results are not a map of the ground and are instead a direct measurement of subsurface properties. Detecting and mapping features requires that said features have properties that can be measured by the chosen technique(s) and that these properties have sufficient contrast with the background to be identifiable. The interpretation of any identified anomalies is inherently subjective. While the scrutiny of the results is undertaken by qualified, experienced individuals and rigorously checked for quality and consistency, it is often not possible to classify all anomaly sources. Where possible an anomaly source will be identified along with the certainty of the interpretation. The only way to improve the interpretation of results is through a process of comparing excavated results with the geophysical reports. MS actively seek feedback on their reports as well as reports of further work in order to constantly improve our knowledge and service.

### 7.2. Discussion

7.2.1. The geophysical results are presented in consideration with satellite imagery and historical maps (Figure 6, 10 & 14).

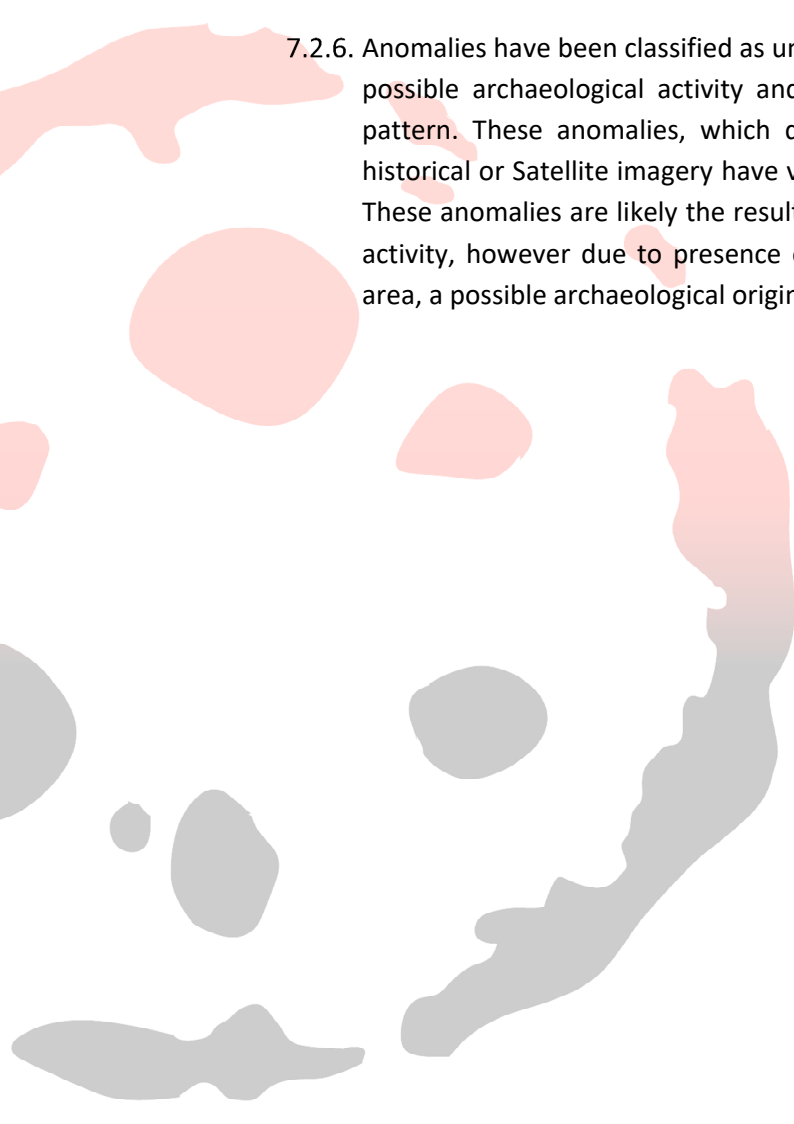
7.2.2. The geophysical survey was successfully completed across the majority of the survey area, with a c. 5.64ha not being surveyed due to the presence of overgrown vegetation and waterlogged ground conditions (Figure 2). The magnetometer survey has responded well to the survey area, with only limited interference from extant field boundaries, electrical pylons, overhead cables, and buried services (Figure 16, 21 & 31). A small number of data artefacts are present within the survey area, caused by the close proximity of high magnitude ferrous anomalies. The survey results reveal a relatively quiet magnetic background, which has allowed for the identification of anomalies of archaeological, modern, agricultural and natural origin.

7.2.3. The survey has expanded upon the available Archaeological background by identifying anomalies of probable archaeological origin located in Areas 2 and 3, north-west of New Forest Farm (Figure 16). These anomalies form a series of fragmented rectangular enclosures, pits and trackways. Further curvilinear and discrete anomalies of probable archaeological origin which share a similar alignment and magnetic signal have been identified within areas of ridge and furrow cultivation. These anomalies, which broadly collate with a Romano-British ladder enclosure identified by previous trial trenching investigation and a geophysical survey, (see Sec. 5.5) have been interpreted to be an extension of these recorded features. In the west of Area 22, the survey has identified several linear and curvilinear anomalies. These anomalies share a similar alignment with the anomalies in Areas 2 and 3. However, due to the limited context of the survey area and the lack of consistent signal and shape, these anomalies have been interpreted to be of possible rather than possible archaeological origin.

7.2.4. A broad curvilinear anomaly running through Area 3 and 4 in an east-west direction has been detected (Figure 10). This anomaly aligns with a former towing path and canal recorded on second edition historical OS maps.

7.2.5. In the southern part of Area 3 and 4 the survey has detected several linear and rectilinear anomalies that intersect the recorded towing path at a right angle. Due to the strong and consistent magnetic signal it is possible that this anomaly is part of the towing path, however no additional canal infrastructure has been recorded on historical maps. It is just as likely that this anomaly is related to the Romano-British settlement to the north. Further to the west several ephemeral curvilinear anomalies have been detected (Figure 37). These have a differing alignment and a weaker magnetic signal, however due to their proximity to archaeological anomalies they are considered to be of possible archaeological origin.

7.2.6. Anomalies have been classified as undetermined when isolated from the probable and possible archaeological activity and lacking any diagnostic archaeological shape or pattern. These anomalies, which do not correspond to any features recorded on historical or Satellite imagery have variable magnetic signals and differing alignments. These anomalies are likely the result of natural variations in the topsoil or agricultural activity, however due to presence of probable archaeological remains in the survey area, a possible archaeological origin cannot be excluded.



## 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. **Data Artefact** – Data artefacts usually occur in conjunction with anomalies with strong magnetic signals due to how the sensors respond to very strong point sources. These 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 features. Therefore, these artefacts are indicated as necessary to preserve the data as ‘minimally processed’.
- 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. **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.
- 7.3.1.6. **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. **Probable Archaeology (Strong and Weak)** – In Areas 2 and 3 the survey has identified a number of linear, curvilinear and discrete anomalies [2a and 3a] aligned in an east-west direction (Figure 16 & 22). These anomalies have clearly defined edges and magnetic signal, suggestive of cut features with magnetically enhanced fill such as ditches, pits and trackways. These anomalies, which exhibit enhanced magnetic signal have been interpreted to be of probable archaeological origin as they may relate to a Romano-British ladder-type enclosure identified within Zone 2 during a previous geophysical survey and later excavated (See Sec. 4.5).
- 7.3.2.2. **Modern/Industrial** – In Areas 3 and 4 the survey has detected a broad curvilinear anomaly [3b and 4a] aligned in an east-west direction (Figure 19 & 22). This anomaly, which has a variable magnetic signal aligns with a towing path and a canal, recorded on the second edition historical OS maps (Figure 10). The difference in magnetic signal is caused by the infill material used to fill in the canal ditch. The survey has also identified a section [4b] of the Wilts and Berks canal on the southern edge of Area 4 (Figure 19). This broad amorphous anomaly has a similar magnetic response to [3a] and has been likely infilled with a similar enhanced material.
- 7.3.2.3. **Possible Archaeology (Strong and Weak)** – In Area 3 the survey has identified a number of linear, curvilinear and discrete anomalies [3c] aligned in a southwest-northeast direction (Figure 22). These anomalies have a variable magnetic signal and clearly defined edges, suggestive of cut features with magnetically enhanced fill. [3c] intersects [3b] at a right angle which might suggest an association with the recorded towing path. This interpretation is supported by the presence of a junction bridge recorded to the west of this anomaly on the historical OS maps (Figure 10). However, due to the presence of a Roman ladder-type settlement [2a and 3a] that shares a similar alignment and magnetic signal to the north, [3c] it is possible that these anomalies represent an earlier feature that was undercut by the towing path. As such [3c] has been interpreted to be of possible rather than probable archaeological origin.
- 7.3.2.4. **Possible Archaeology (Strong and Weak)** – On the eastern edge of Area 22, the survey has detected several curvilinear anomalies [22a] of variable magnetic strength (Figure 37). These anomalies, which are aligned in a north-south direction exhibit the characteristics of ditch-type features with magnetically enhanced fill. Due to the presence of anomalies of Romano British origin c.1km to the east [2a and 3a], they have been interpreted to be of possible archaeological origin. However, due to limited size, and therefore limited context of the survey area this interpretation remains tentative.
- 7.3.2.5. **Agricultural (Strong and Weak)** – In Areas 1 and 4 the survey has identified two linear [4c] and rectilinear [1a] anomalies of variable magnetic signal (Figure 16 & 19). These anomalies, which exhibit the characteristics of ditches infilled with magnetically enhanced material, have been interpreted as former field

boundaries, as they run in line with field boundaries recorded on the historical OS maps (Figure 6). In Area 23 the survey has identified a weak linear anomaly [23a] aligned in a northwest-southeast direction. This anomaly, which exhibits a similar alignment to a former field boundary to the west of the survey area, has been interpreted as possible unrecorded boundary as it shares an alignment with a recorded former field boundary to the west (Figure 6). In the northern part of Area 13 the survey has identified a faint curvilinear anomaly [13a] (Figure 34). This anomaly co-locates with a modern trackway visible on satellite imagery (Figure 14).

7.3.2.6. **Agricultural (Trends)/ (Ridge and Furrow)** – Recent ploughing activity has been detected across the majority of the survey area. These are identified as tightly spaced linear anomalies, parallel to each other and following the lines of cultivation as recorded on the satellite mapping (Figure 6, 10 & 14). In Area 3, 4, 7, 13, 15, 19 & 24, weak curvilinear parallel anomalies have been identified (Figure 16, 19, 22, 25, 28, 31, 34 & 37). Due to the relatively wide spacing (c.6m) and slight curve these anomalies have been interpreted as historical ridge of furrow cultivation.

7.3.2.7. **Undetermined (Strong and Weak)** – A number of isolated linear and discrete anomalies have been identified across the entirety of the survey area which are not readily associated with the archaeological activity across the site (Figure 19, 22, 25, 28, 31 & 37). These anomalies have weak magnetic signals, with no clear form or pattern to suggest archaeological activity. These anomalies may also relate to natural or potentially very weakly enhanced anthropogenic activity of uncertain date. Nonetheless, due to the presence of probable and possible archaeological anomalies, an archaeological origin cannot be dismissed. On the northern edge of Area 7 the survey has identified a broad, amorphous anomaly [7a] (Figures 25 & 26). This anomaly exhibits a strong magnetic signal indicative of a pit-type feature with a magnetically enhanced fill. It is possible that this anomaly is a former extraction pit since Forest Brickworks quarry is recorded c.100m directly to the north (Figure 6). However, due to the fact that there is no historical record of an extraction pit in the historical OS maps this anomaly is considered to be of undetermined origin.

7.3.2.8. **Natural (Strong, Weak and Spread)** – Across the survey are a series of zones broad curvilinear anomalies of variable magnetic strength have been detected (Figures 19, 22, 25, 28, 34 & 37). These anomalies which follow the topographical slopes exhibit the characteristics of anomalies of natural origin likely due to the geological variation between the mudstone bedrock and the alluvial superficial deposits.

7.3.2.9. **Services** – In Areas 1, 5, 6, 13, 20 and 21 (Figure 16, 19, 32 & 37), the survey has identified a number dipolar linear anomalies. These anomalies exhibit a strong magnetic signal characteristic of buried services.

7.3.2.10. **Drains** – Across the majority of the survey area, a number of faint linear anomalies that form a herringbone pattern and terminate at the field edges have been identified (Figure 19, 22, 25, 28, 31 & 37). These anomalies, which exhibit a weakly dipolar magnetic signal and can be clearly seen in the XY Trace plot (Figure 9, 12 & 15), have been interpreted as field drains.

7.3.2.11. **Overhead Cable Effect** – In Area 2, the survey has detected two high magnitude linear bands running in a northeast-southwest and southwest-northeast direction (Figure 16). These anomalies, which collocate with overhead electrical cables, have been interpreted as magnetic interference caused by these extant features.

## 8. Conclusions

- 8.1. A fluxgate gradiometer survey was successfully completed across the vast majority of Zone 2. The survey has revealed a relatively quiet magnetic background, allowing for a confident interpretation of the data and the location of sub-surface archaeological remains. The wider archaeological landscape is known to reflect the occupation of this area through the prehistoric, Romano-British and medieval periods. The survey has expanded upon the extent previously identified Romano-British activity in the zone, and detected further possible archaeological anomalies of uncertain date.
- 8.2. The focus of probable archaeological activity is located in the north-eastern of the survey area. It comprises of anomalies indicative of cut features, containing anthropogenically enhanced fill, such as ditched enclosures, discrete pits and trackways. The presence of these anomalies expands upon the results of a previous investigation within Zone 2 which dated such anomalies to the Romano-British period.
- 8.3. In the east of Zone 2, the survey has identified a broad curvilinear anomaly that collate with a former canal and towing path, recorded on second edition historical OS maps. Further to the south a number of linear and rectilinear anomalies have been identified as possible canal infrastructure related to a nearby junction bridge.
- 8.4. The historical agricultural utilisation of the survey area has been identified in the form of ridge and furrow cultivation, and former field boundaries recorded on historical second edition OS maps. Modern agricultural anomalies such as modern ploughing trends, trackways and field drains have also been detected.
- 8.5. Anomalies have been classified as undetermined when isolated from the probable and possible archaeological activity and lacking any diagnostic archaeological shape or pattern, however these anomalies may still relate to archaeological activity.
- 8.6. Modern anomalies include magnetic disturbance caused by buried services, electric pylons, overhead cables and the presence of ferrous material along the field edges.

## 9. Archiving

- 9.1. MS maintains an in-house digital archive, which is based on Schmidt and Ernenwein (2013). This stores the collected measurements, minimally processed data, georeferenced and un-georeferenced images, XY traces and a copy of the final report.
- 9.2. MS contributes reports to the ADS Grey Literature Library upon permission from the client, subject to the any dictated time embargoes.

## 10. Copyright

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## 11. References

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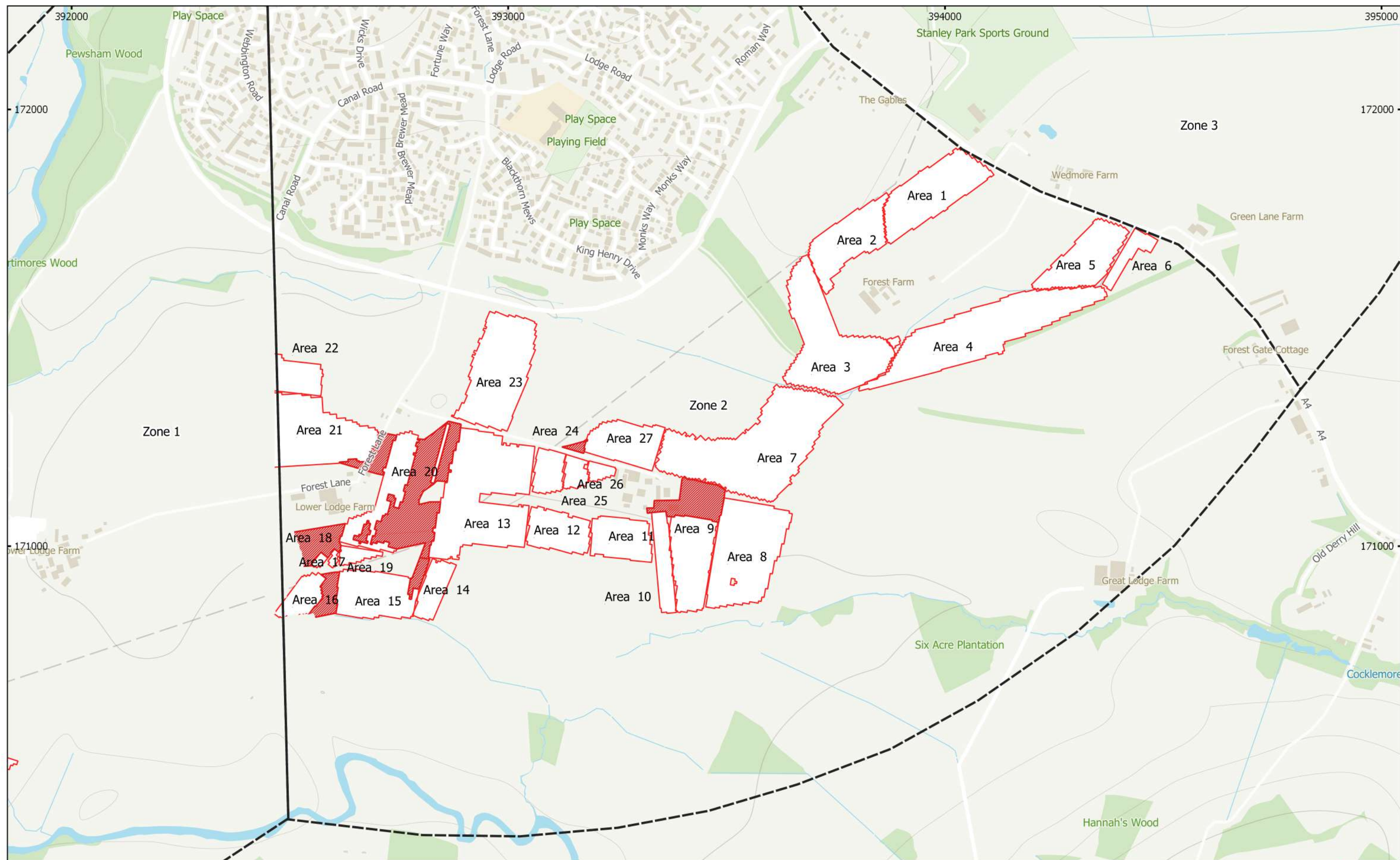
## 12. Project Metadata

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| MS Job Code       | MSST732                                       |
| Project Name      | Future Chippenham Proposals: Reporting Zone 2 |
| Client            | Atkins                                        |
| Grid Reference    | ST 9408 7337                                  |
| Survey Techniques | Magnetometry                                  |
| Survey Size (ha)  | 53ha (Magnetometry),                          |
| Survey Dates      | 2020-10-05 to 2020-10-15                      |
| Project Lead      | Leanne Swinbank BA ACIfA                      |
| Project Officer   | Leanne Swinbank BA ACIfA                      |
| HER Event No      | N/A                                           |
| OASIS No          | N/A                                           |
| S42 Licence No    | N/A                                           |
| Report Version    | 1.0                                           |

## 13. Document History

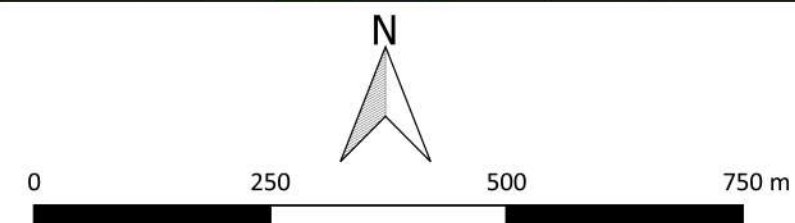
| Version | Comments                                 | Author                         | Checked By                                                          | Date                |
|---------|------------------------------------------|--------------------------------|---------------------------------------------------------------------|---------------------|
| 0.1     | Initial draft for Project Lead to Review | Krasimir Dyulgerski<br>BA MRes | Leanne Swinbank BA<br>ACIfA                                         | 11 February<br>2021 |
| 0.2     | Corrections after Project Lead Review    | Krasimir Dyulgerski<br>BA MRes | Finnegan Pope-<br>Carter BSc MSc FGS,<br>Dr Kayt Armstrong<br>MCIfA | 16 February<br>2021 |
| 1.0     | Report following client corrections.     | Krasimir Dyulgerski<br>BA MRes | Leanne Swinbank BA<br>ACIfA                                         | 24 March<br>2021    |





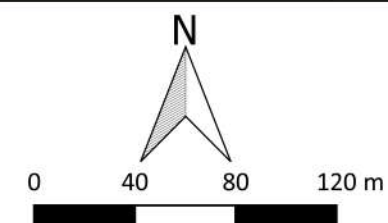
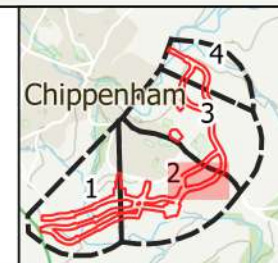
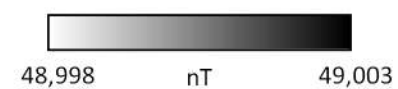
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-  Reporting Zones
-  Survey Extent
-  Unserved Areas



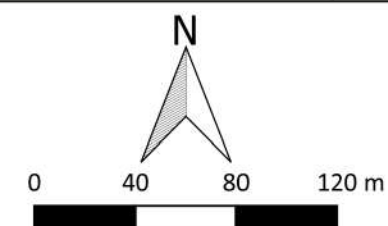
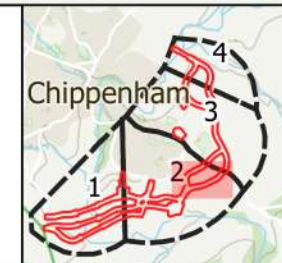
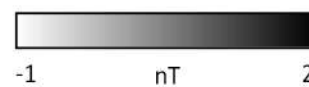


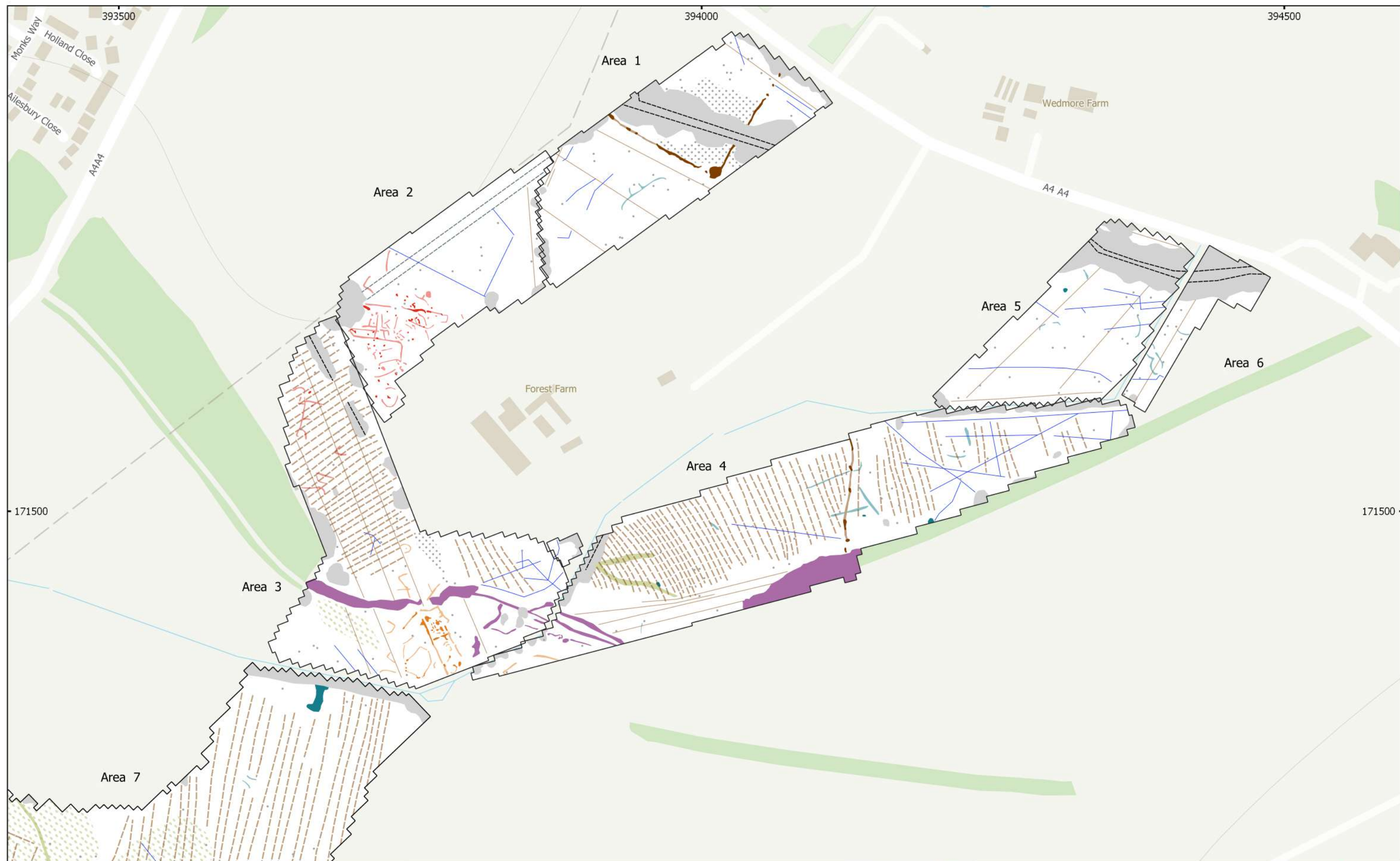
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 Figure 3 - Magnetic Total Field (Lower Sensor) (Overview) (Northern)  
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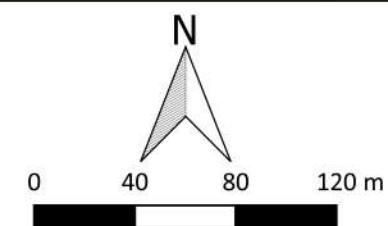
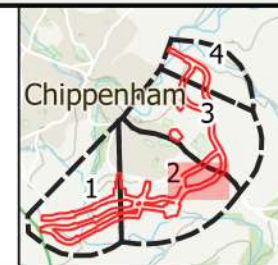
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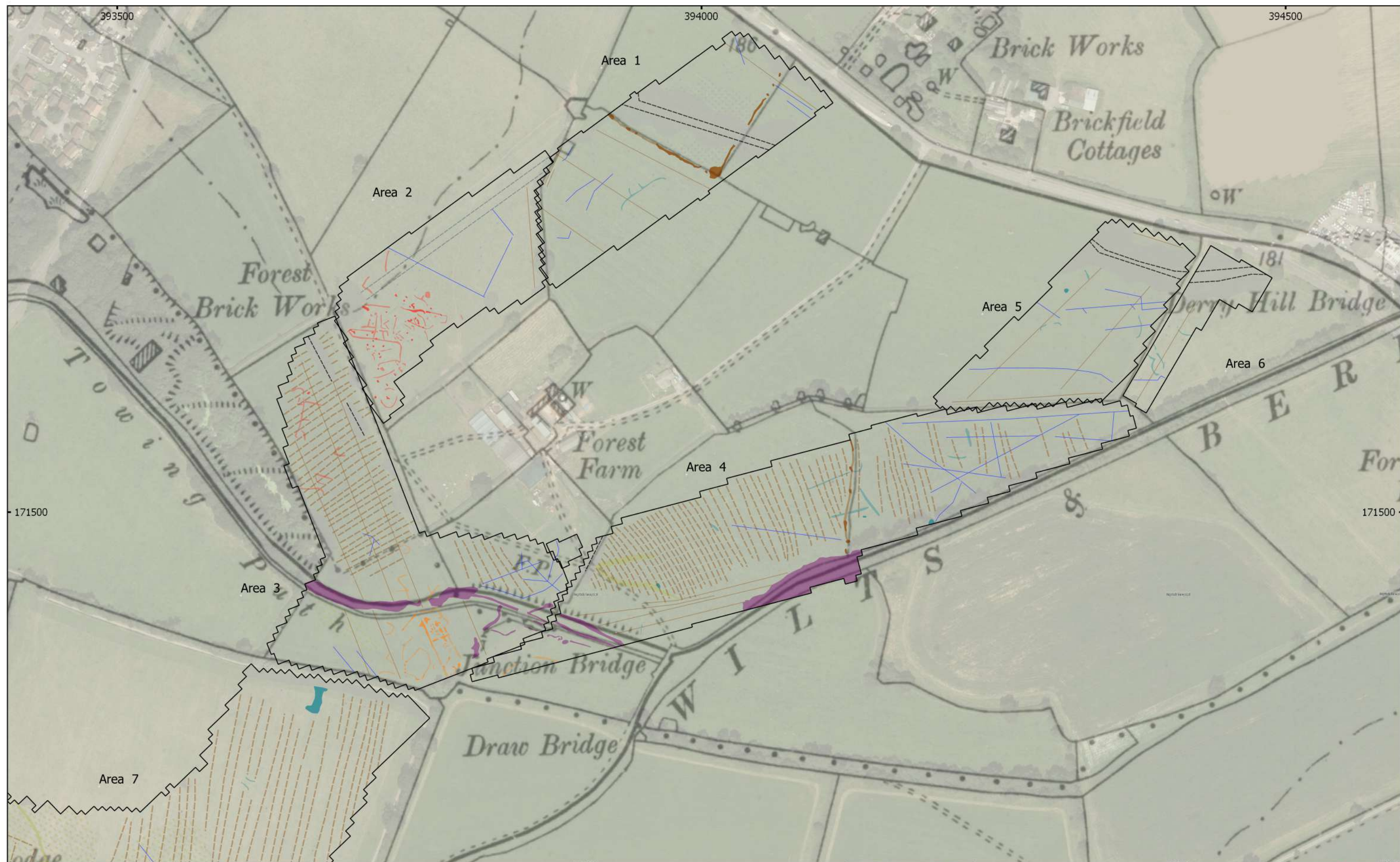




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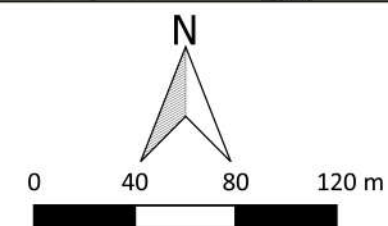
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| Archaeology Probable (Weak)   | Natural (Weak)          | Service                  |
| Archaeology Possible (Strong) | Natural (Zone)          | Ridge and Furrow (Trend) |
| Archaeology Possible (Weak)   | Magnetic Disturbance    | Drainage Feature         |
| Agricultural (Strong)         | Ferrous/Debris (Spread) | Overhead Cable Effect    |
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|                               | Undetermined (Weak)     |                          |





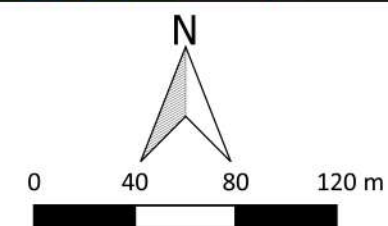
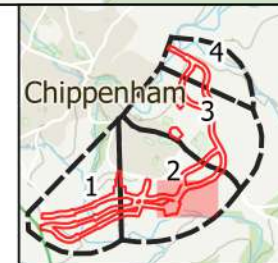
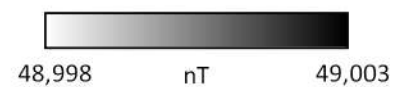
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 Figure 6 - Magnetic Interpretation Over Historic Maps and Satellite Imagery (Overview) (Northern)  
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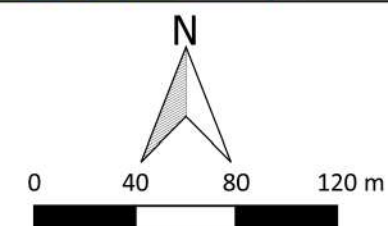
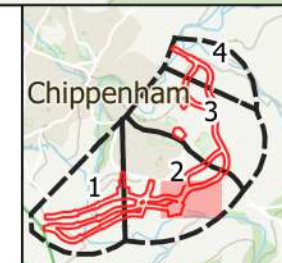
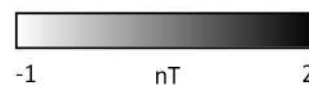


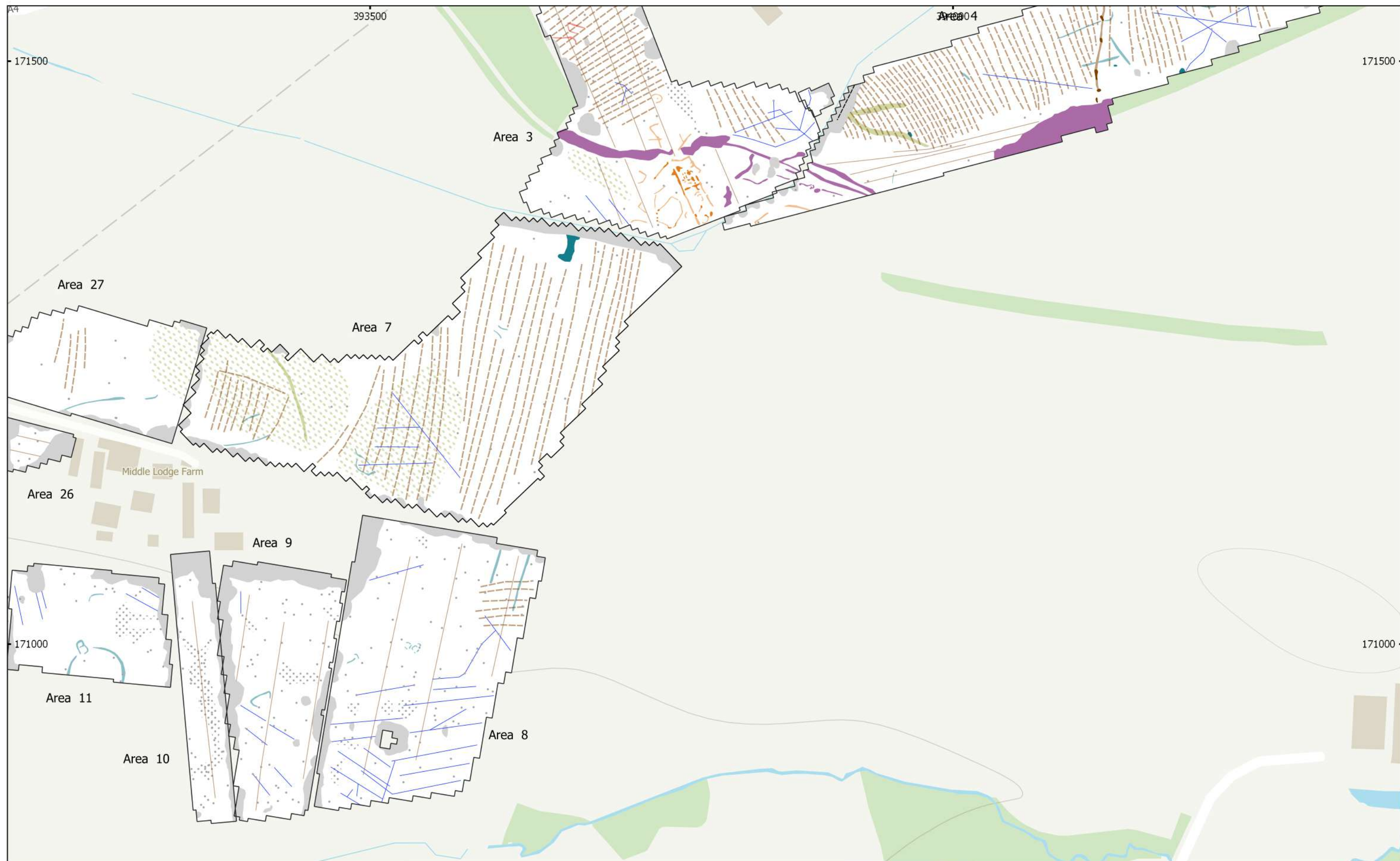
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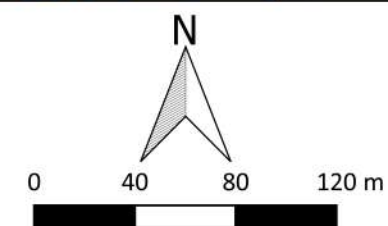
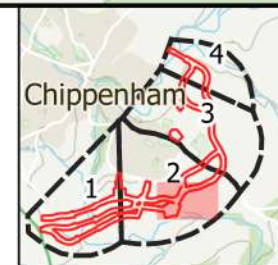
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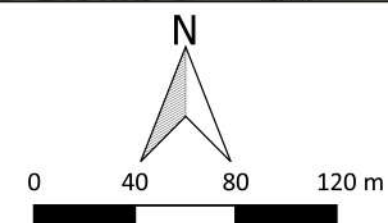
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| Archaeology Possible (Strong) | Natural (Zone)          | Service                  |
| Archaeology Possible (Weak)   | Magnetic Disturbance    | Ridge and Furrow (Trend) |
| Agricultural (Strong)         | Ferrous/Debris (Spread) | Drainage Feature         |
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| Modern/Industrial             | Undetermined (Weak)     |                          |





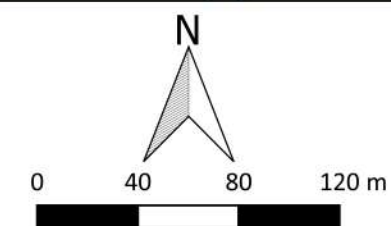
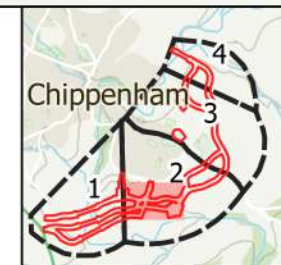
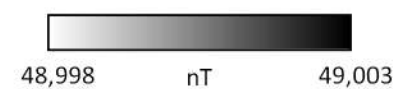
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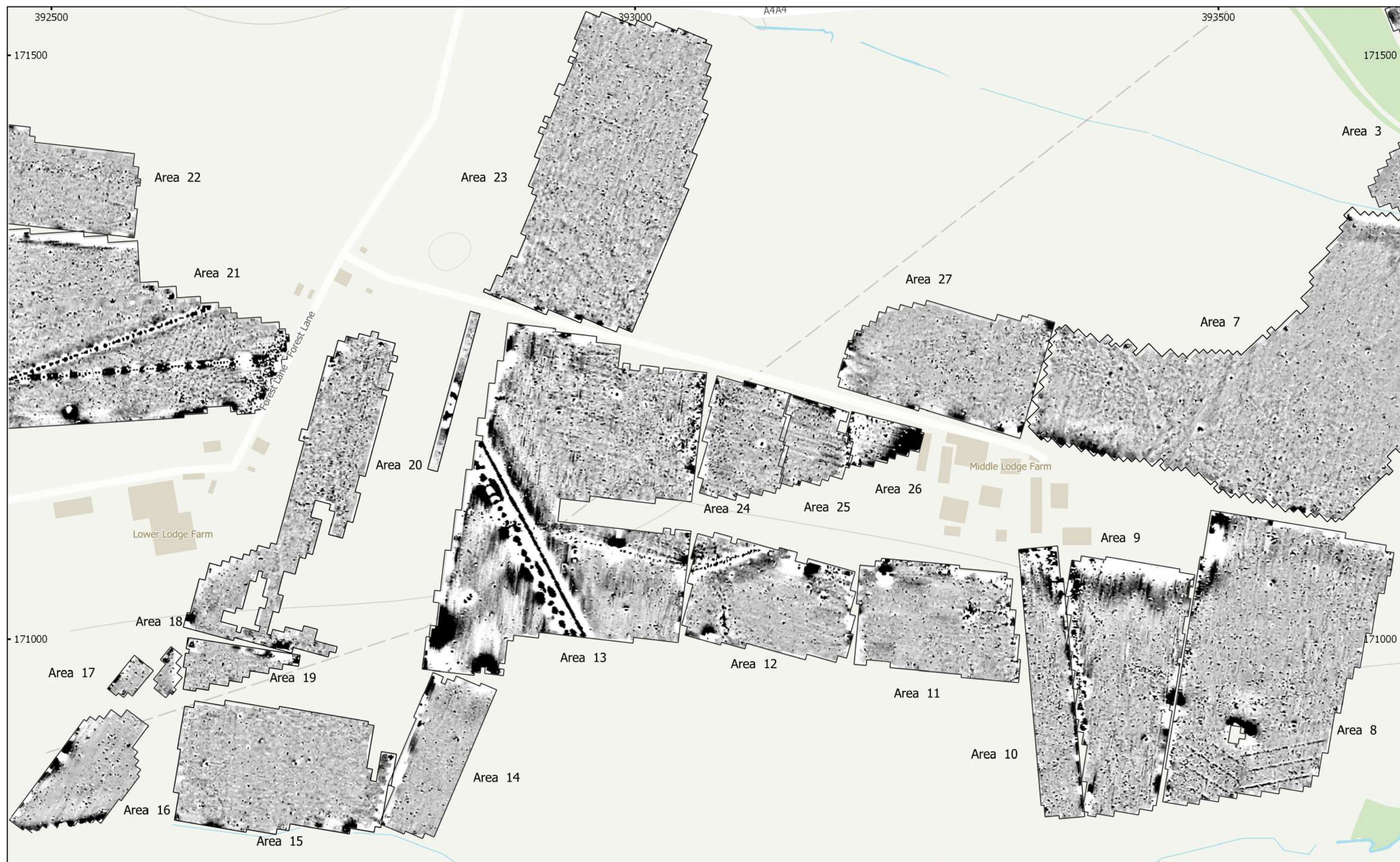
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| Archaeology Possible (Weak)   | Magnetic Disturbance    | Ridge and Furrow (Trend) |
| Agricultural (Strong)         | Ferrous/Debris (Spread) | Drainage Feature         |
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| Modern/Industrial             | Undetermined (Weak)     |                          |



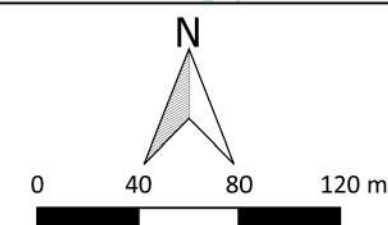
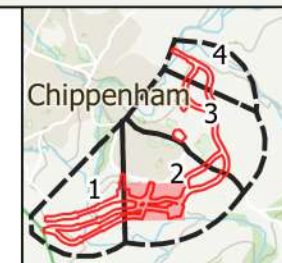
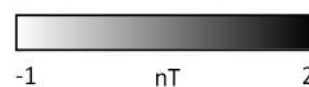


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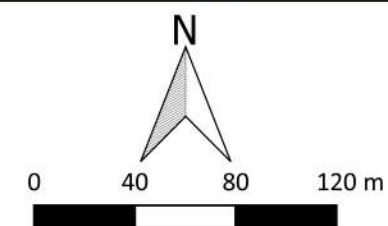
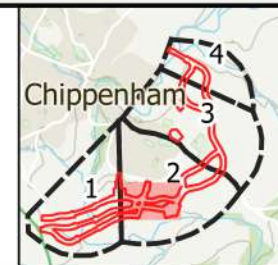
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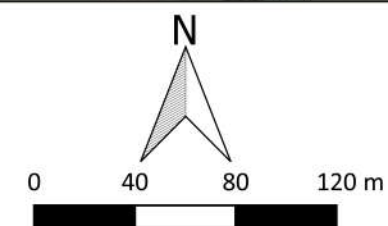
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| Archaeology Possible (Strong) | Natural (Zone)          | Data Artefact            |
| Archaeology Possible (Weak)   | Magnetic Disturbance    | Service                  |
| Agricultural (Strong)         | Ferrous/Debris (Spread) | Ridge and Furrow (Trend) |
| Agricultural (Weak)           | Undetermined (Strong)   | Drainage Feature         |
| Natural (Strong)              | Undetermined (Weak)     | Ferrous (Spike)          |





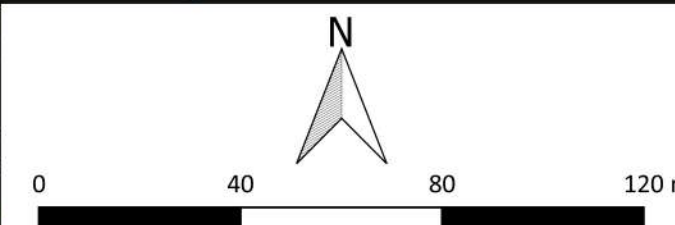
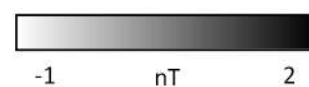
MSST732 - Future Chippenham Planning Road  
 Figure 14 - Magnetic Interpretation Over Historic Maps and Satellite Imagery (Overview) (Southern)  
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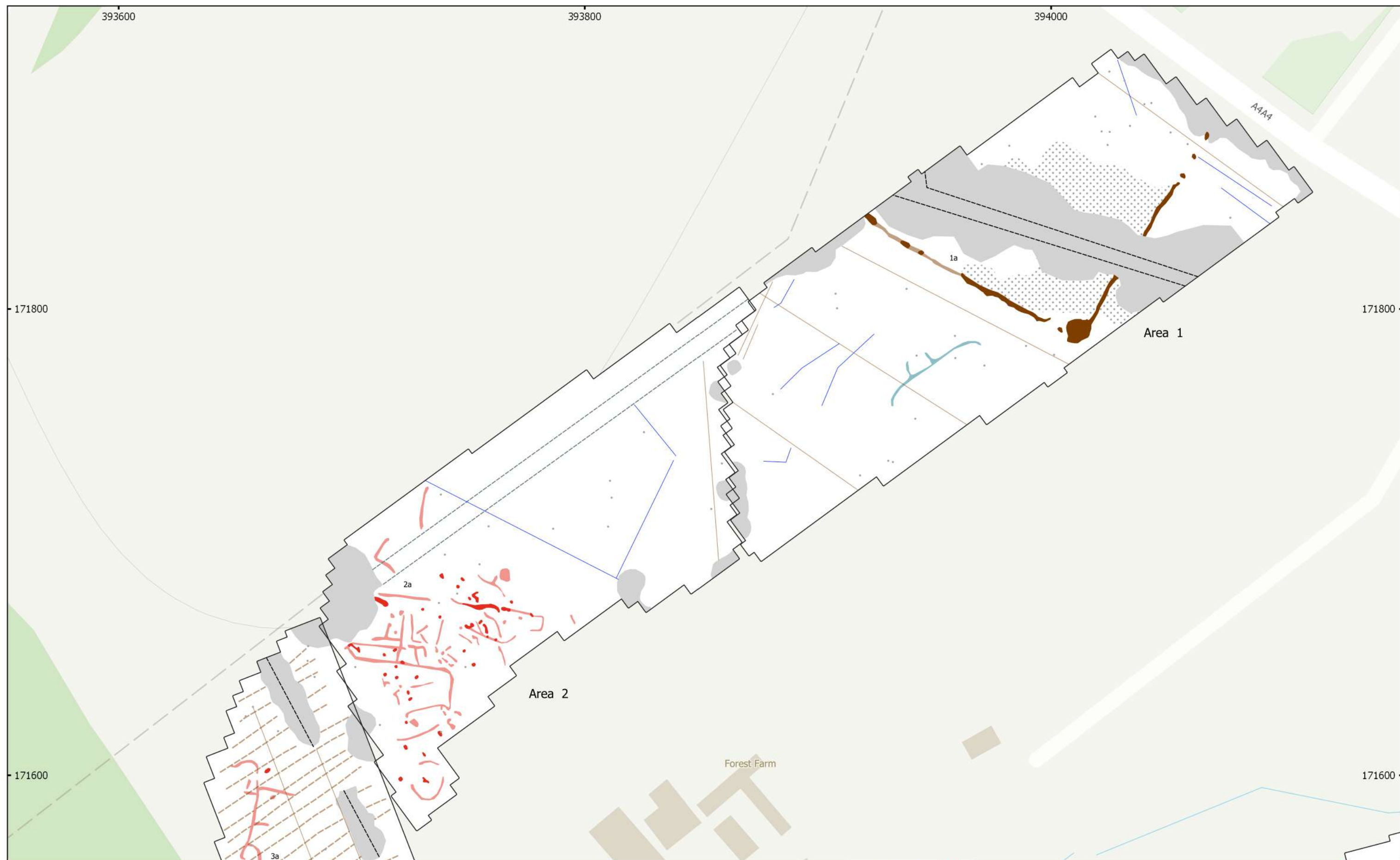
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|-------------------------------|-------------------------|--------------------------|
| Archaeology Probable (Weak)   | Natural (Weak)          | Agricultural (Trend)     |
| Archaeology Possible (Strong) | Natural (Zone)          | Data Artefact            |
| Archaeology Possible (Weak)   | Magnetic Disturbance    | Service                  |
| Agricultural (Strong)         | Ferrous/Debris (Spread) | Ridge and Furrow (Trend) |
| Agricultural (Weak)           | Undetermined (Strong)   | Drainage Feature         |
| Natural (Strong)              | Undetermined (Weak)     | Ferrous (Spike)          |





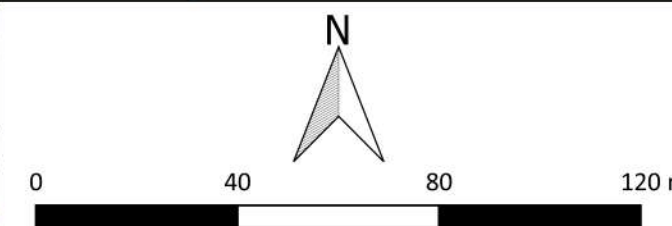
MSST732 - Future Chippenham Planning Road  
 Figure 15 - Magnetic Gradient (Areas 1, 2 & 3)  
 1:1,500 @ A3  
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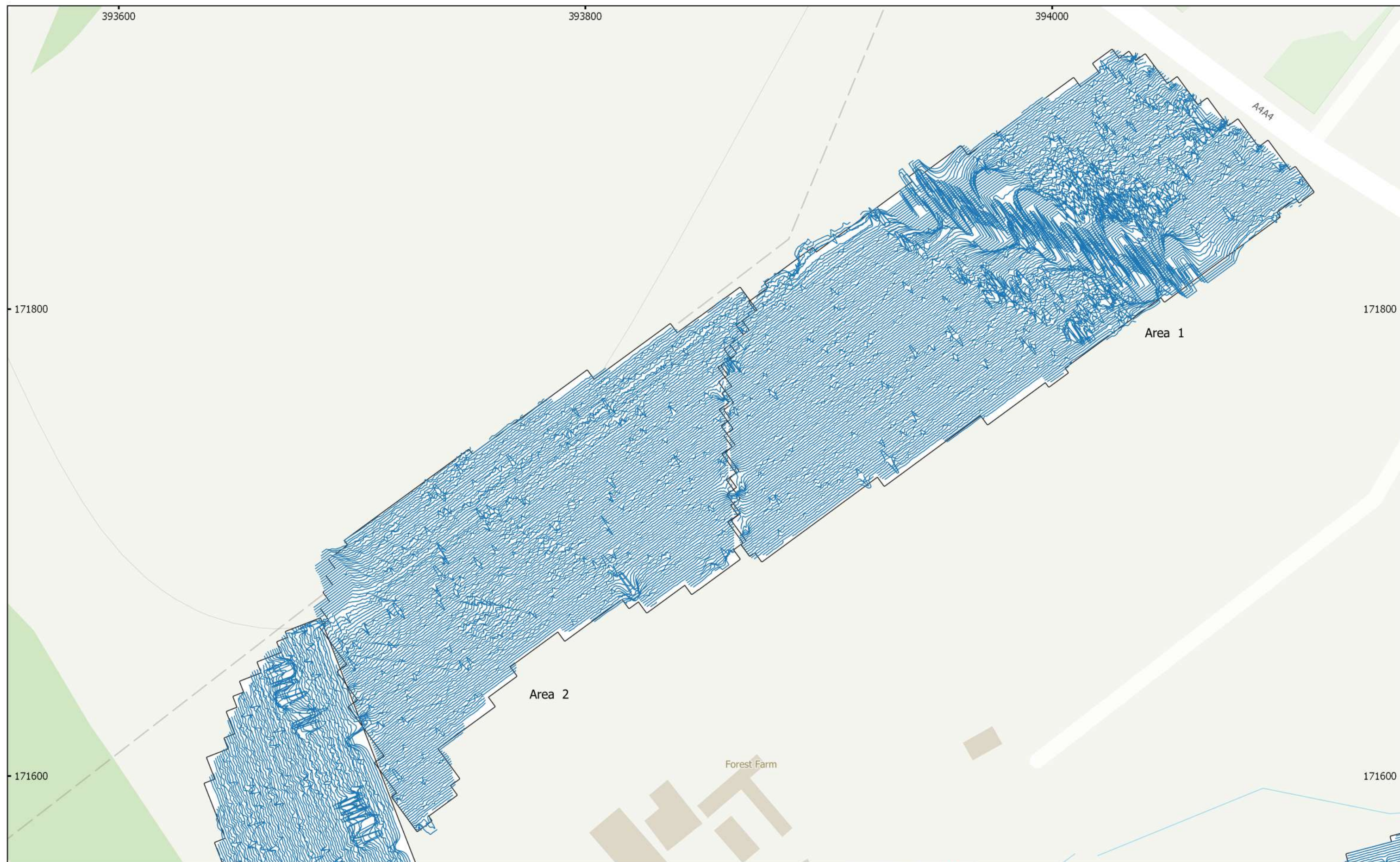




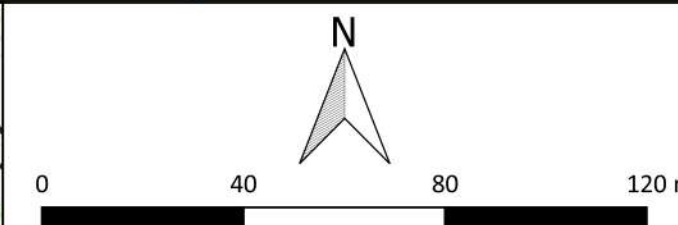
MSST732 - Future Chippenham Planning Road  
 Figure 16 - Magnetic Interpretation (Areas 1, 2 & 3)  
 1:1,500 @ A3  
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- |                                 |                           |                            |
|---------------------------------|---------------------------|----------------------------|
| ■ Archaeology Probable (Strong) | ■ Magnetic Disturbance    | — Ridge and Furrow (Trend) |
| ■ Archaeology Probable (Weak)   | ■ Ferrous/Debris (Spread) | — Drainage Feature         |
| ■ Agricultural (Strong)         | ■ Undetermined (Weak)     | --- Overhead Cable Effect  |
| ■ Agricultural (Weak)           | — Agricultural (Trend)    | • Ferrous (Spike)          |
|                                 | --- Service               |                            |

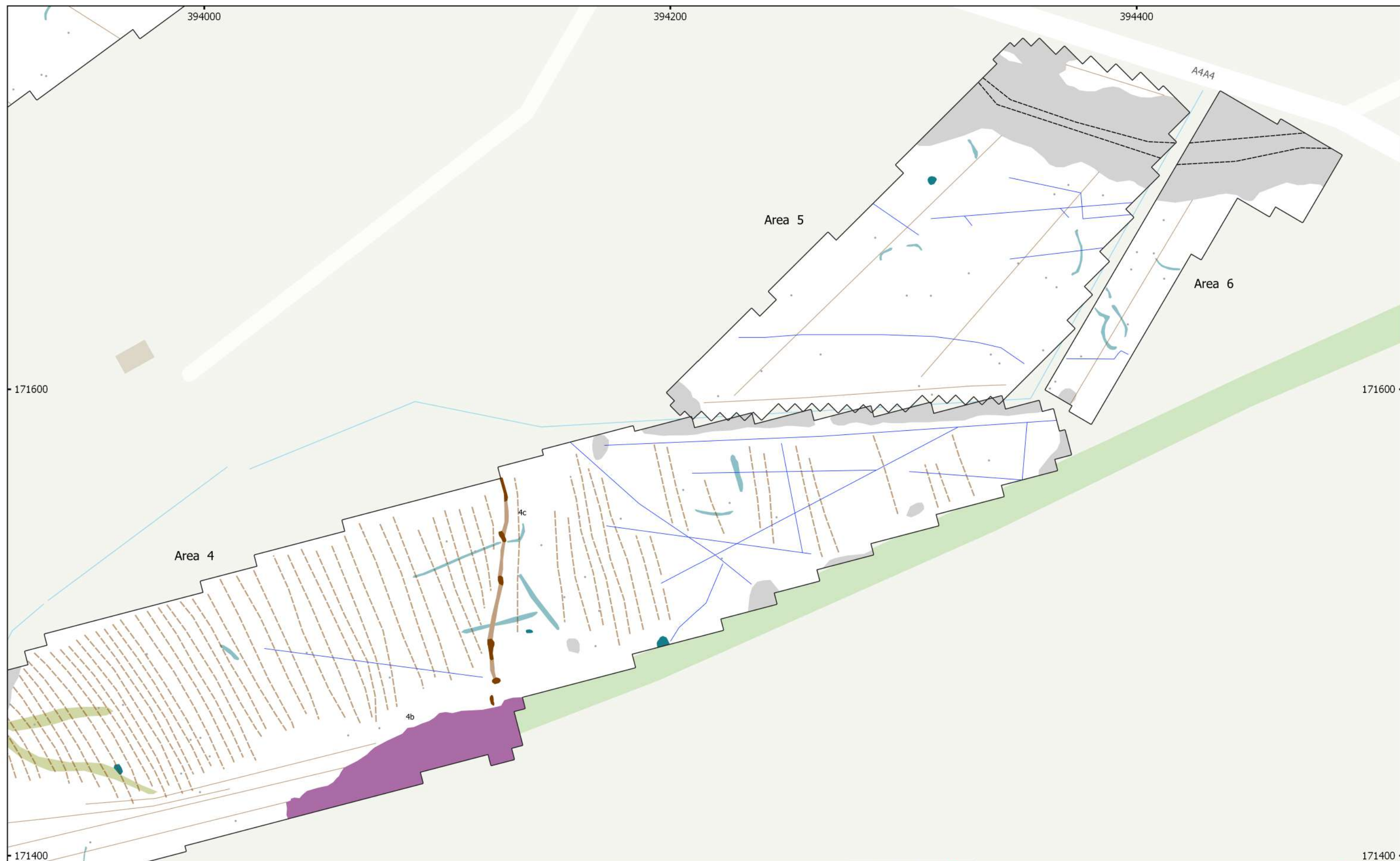




MSST732 - Future Chippenham Planning Road  
Figure 17 - XY Trace Plot (Areas 1, 2 & 3)  
30nT/cm at 1:1,500 @ A3  
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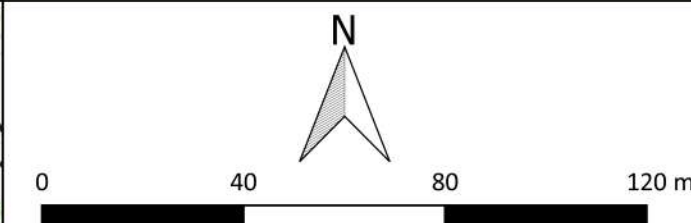


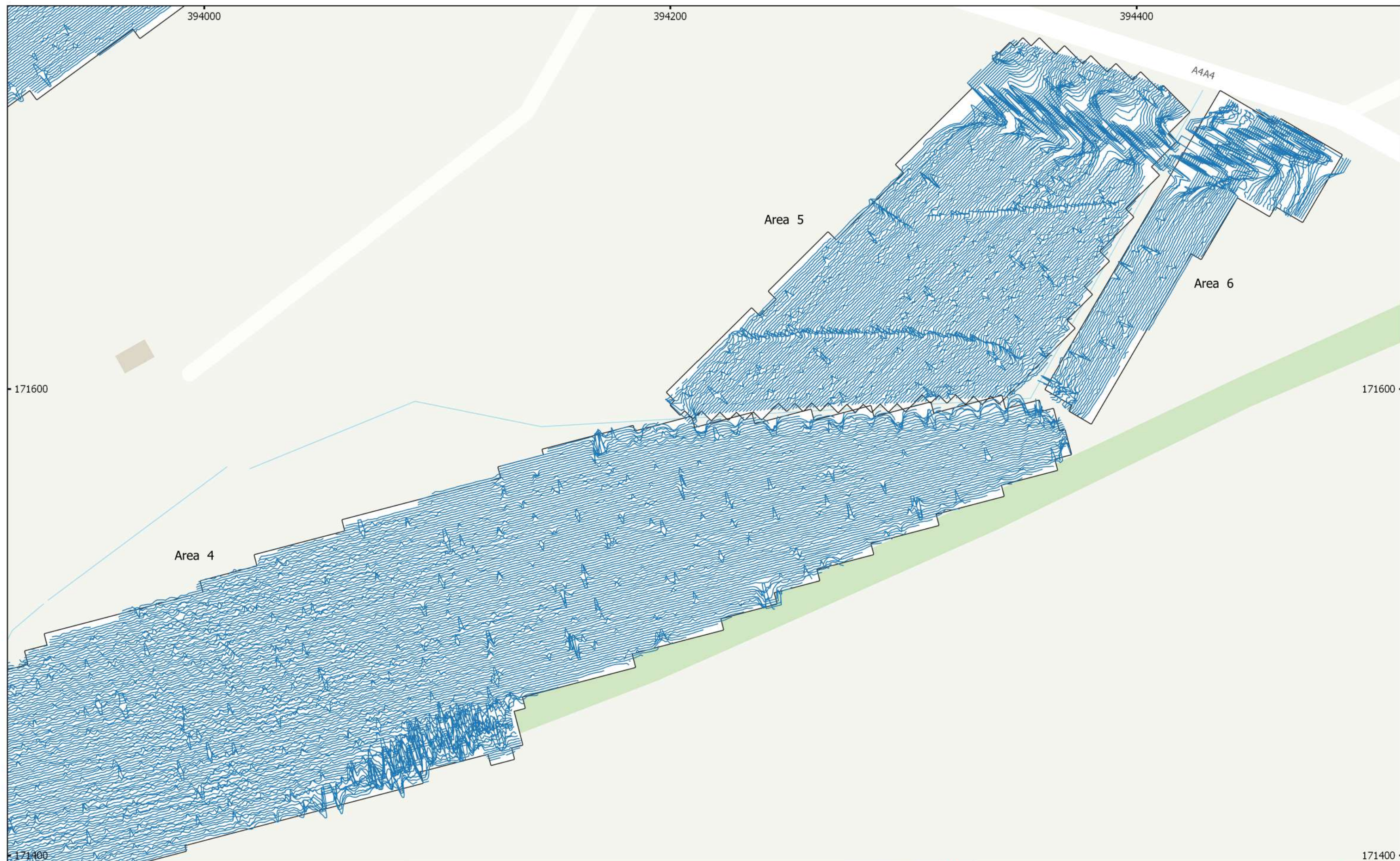




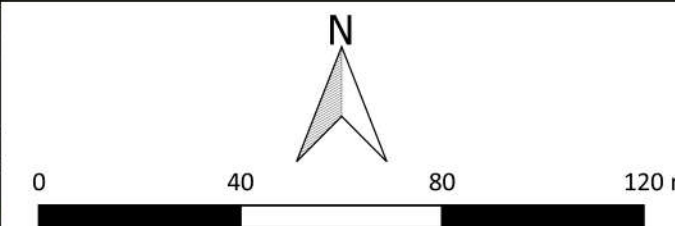
MSST732 - Future Chippenham Planning Road  
 Figure 19 - Magnetic Interpretation (Areas 4, 5 & 6)  
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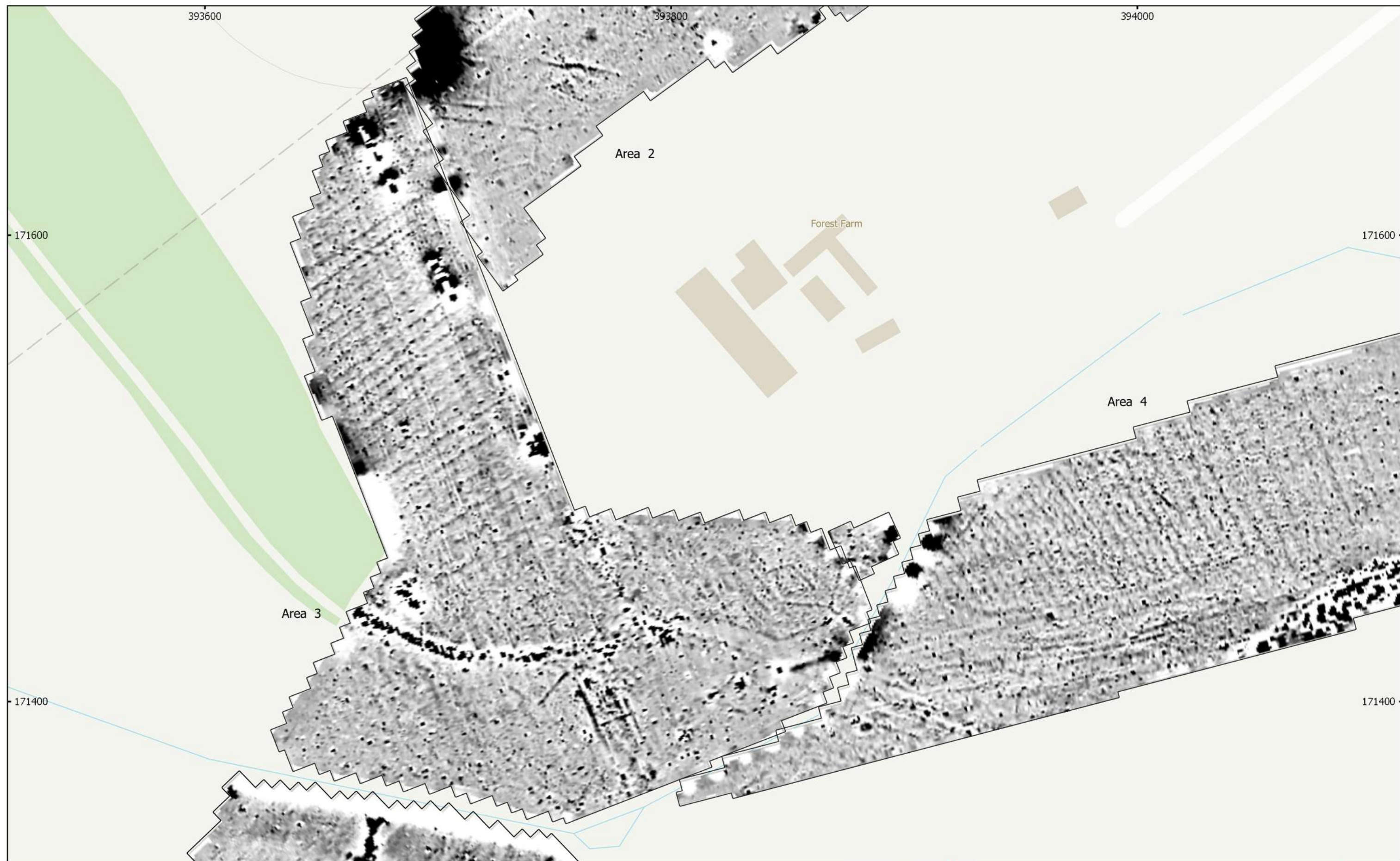
- |                       |                       |                          |
|-----------------------|-----------------------|--------------------------|
| Agricultural (Strong) | Magnetic Disturbance  | Service                  |
| Agricultural (Weak)   | Undetermined (Strong) | Ridge and Furrow (Trend) |
| Modern/Industrial     | Undetermined (Weak)   | Drainage Feature         |
| Natural (Weak)        | Agricultural (Trend)  | Ferrous (Spike)          |



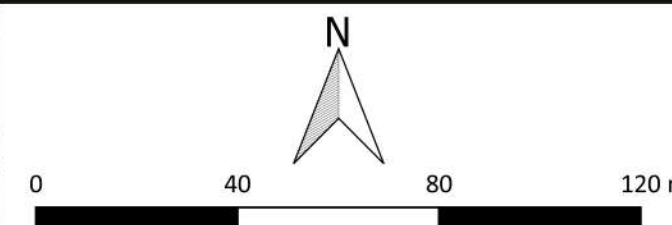
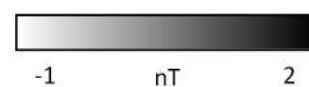


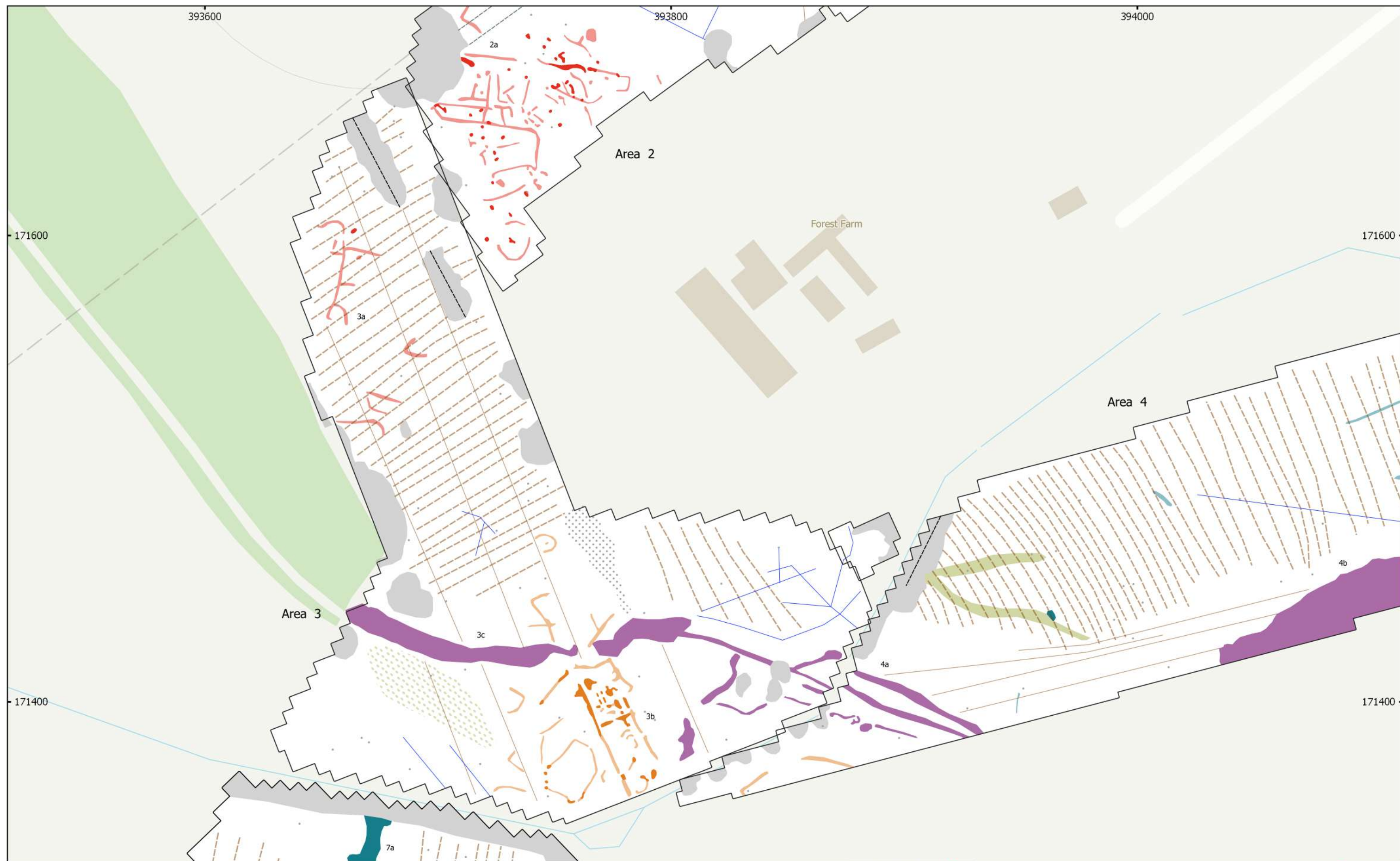
MSST732 - Future Chippenham Planning Road  
 Figure 20 - XY Trace Plot (Areas 4, 5 & 6)  
 30nT/cm at 1:1,500 @ A3  
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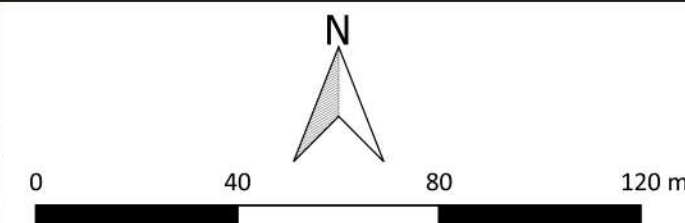
MSST732 - Future Chippenham Planning Road  
 Figure 21 - Magnetic Gradient (Areas 2, 3, 4 & 7)  
 1:1,500 @ A3  
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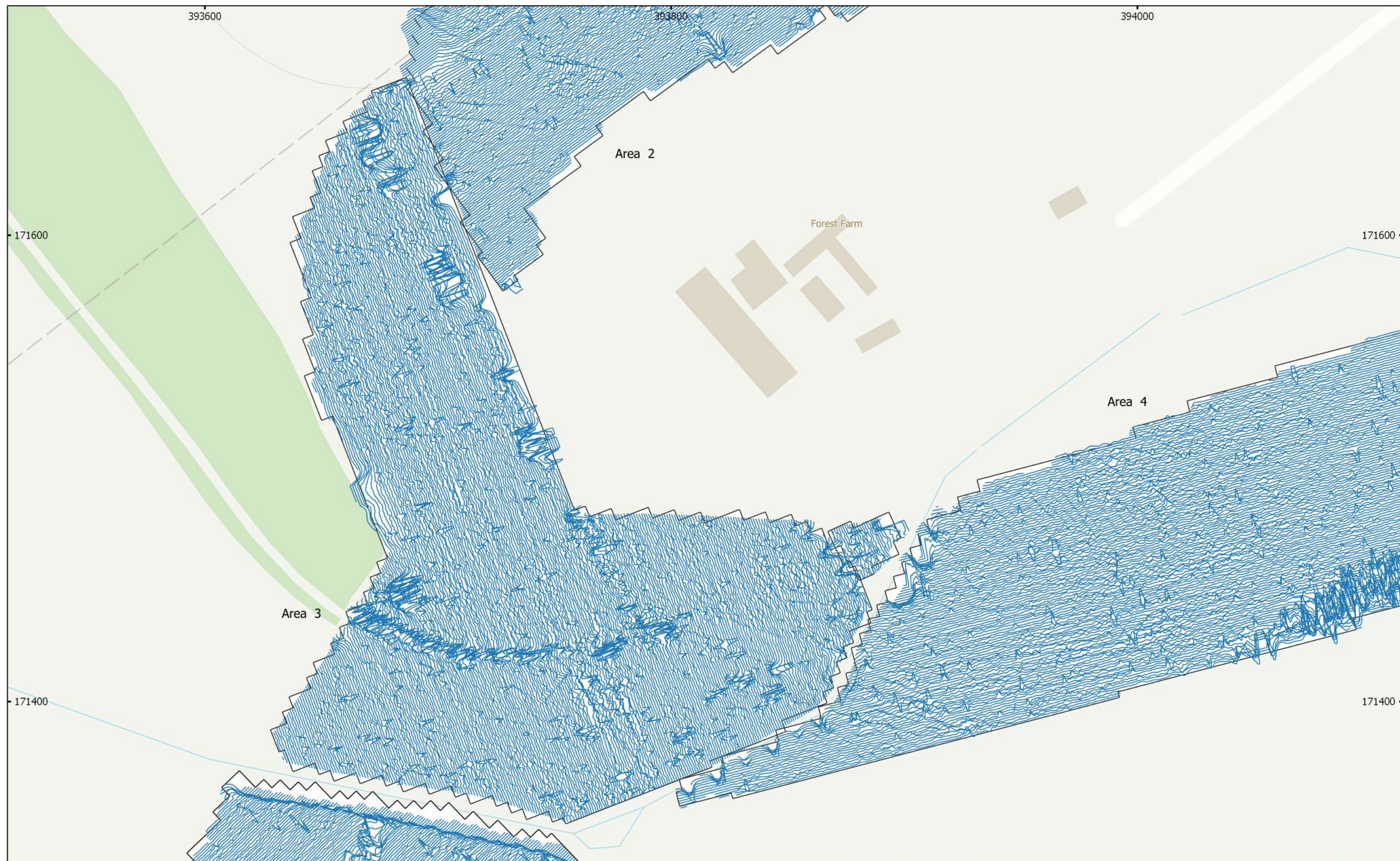




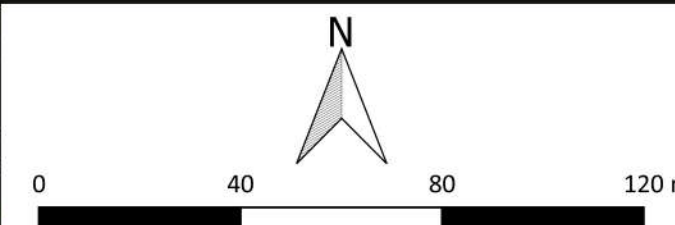
MSST732 - Future Chippenham Planning Road  
 Figure 22 - Magnetic Interpretation (Areas 2, 3, 4 & 7)  
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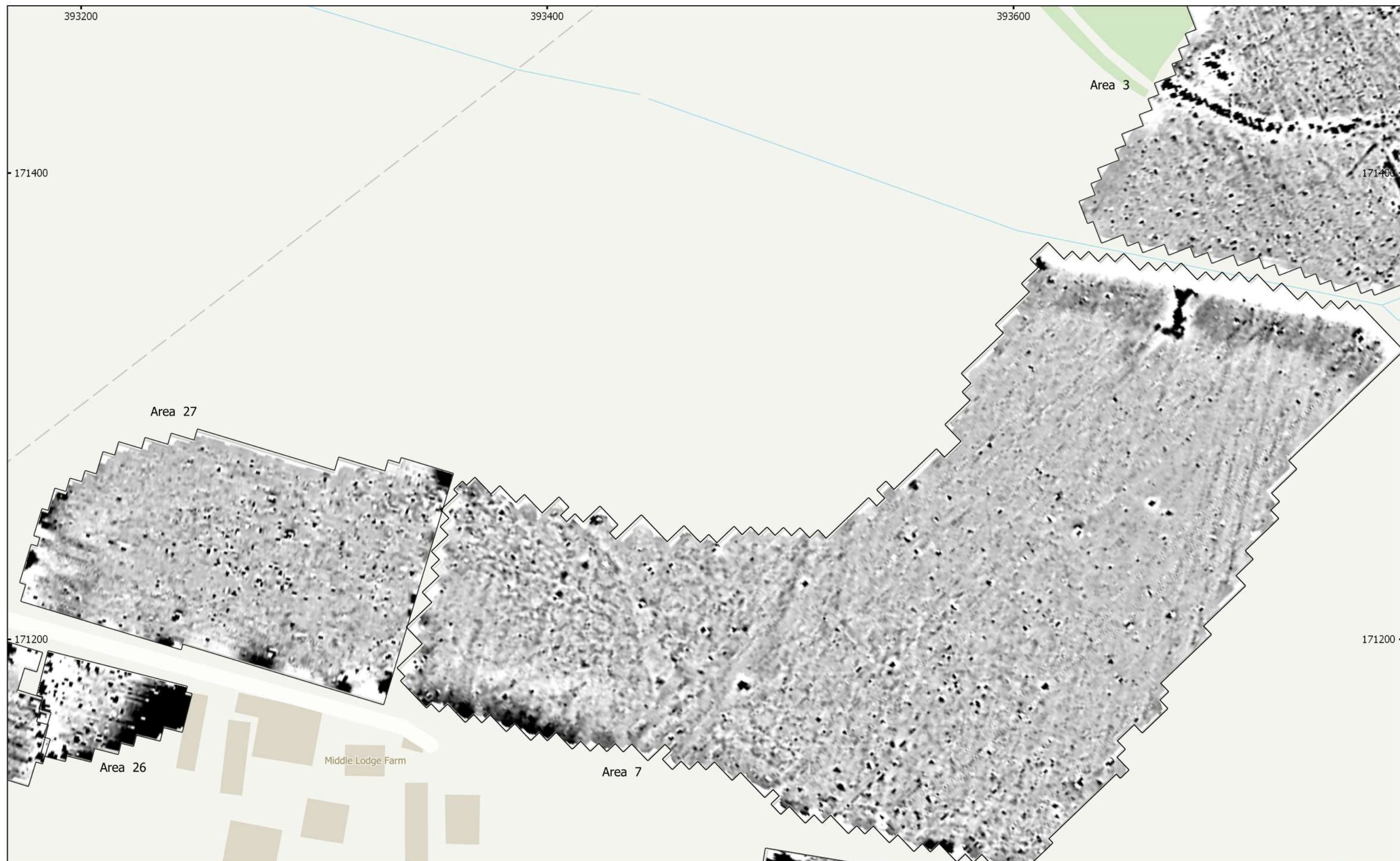
- |                               |                         |                          |
|-------------------------------|-------------------------|--------------------------|
| Archaeology Probable (Strong) | Natural (Zone)          | Service                  |
| Archaeology Probable (Weak)   | Magnetic Disturbance    | Ridge and Furrow (Trend) |
| Archaeology Possible (Strong) | Ferrous/Debris (Spread) | Drainage Feature         |
| Archaeology Possible (Weak)   | Undetermined (Strong)   | Overhead Cable Effect    |
| Modern/Industrial             | Undetermined (Weak)     | Ferrous (Spike)          |
| Natural (Weak)                | Agricultural (Trend)    |                          |



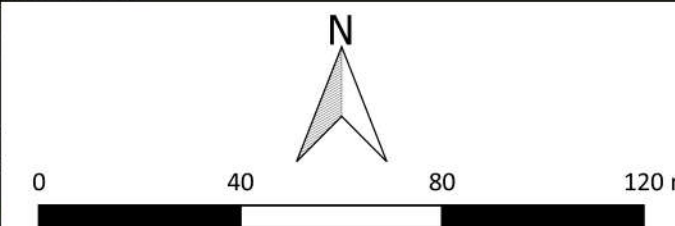
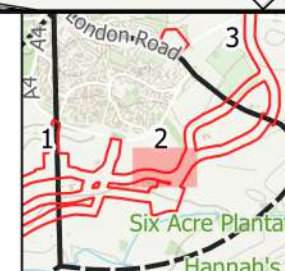
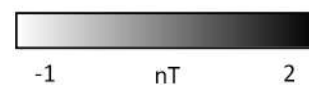


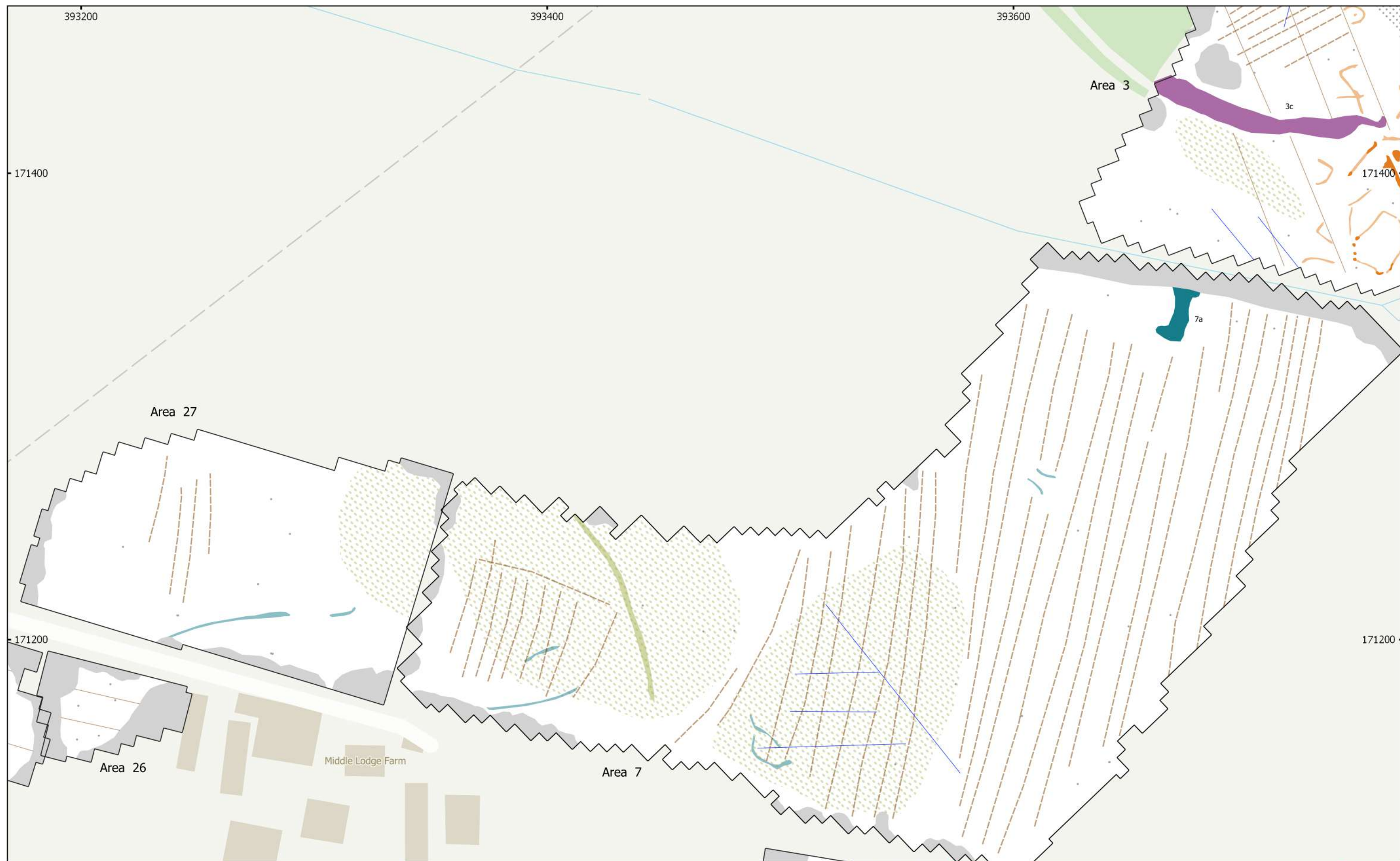
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Figure 23 - XY Trace Plot (Areas 2, 3, 4 & 7)  
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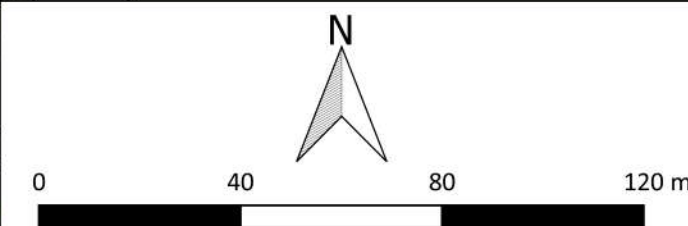
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 Figure 24 - Magnetic Gradient (Areas 3, 7, 25, 26 & 27)  
 1:1,500 @ A3  
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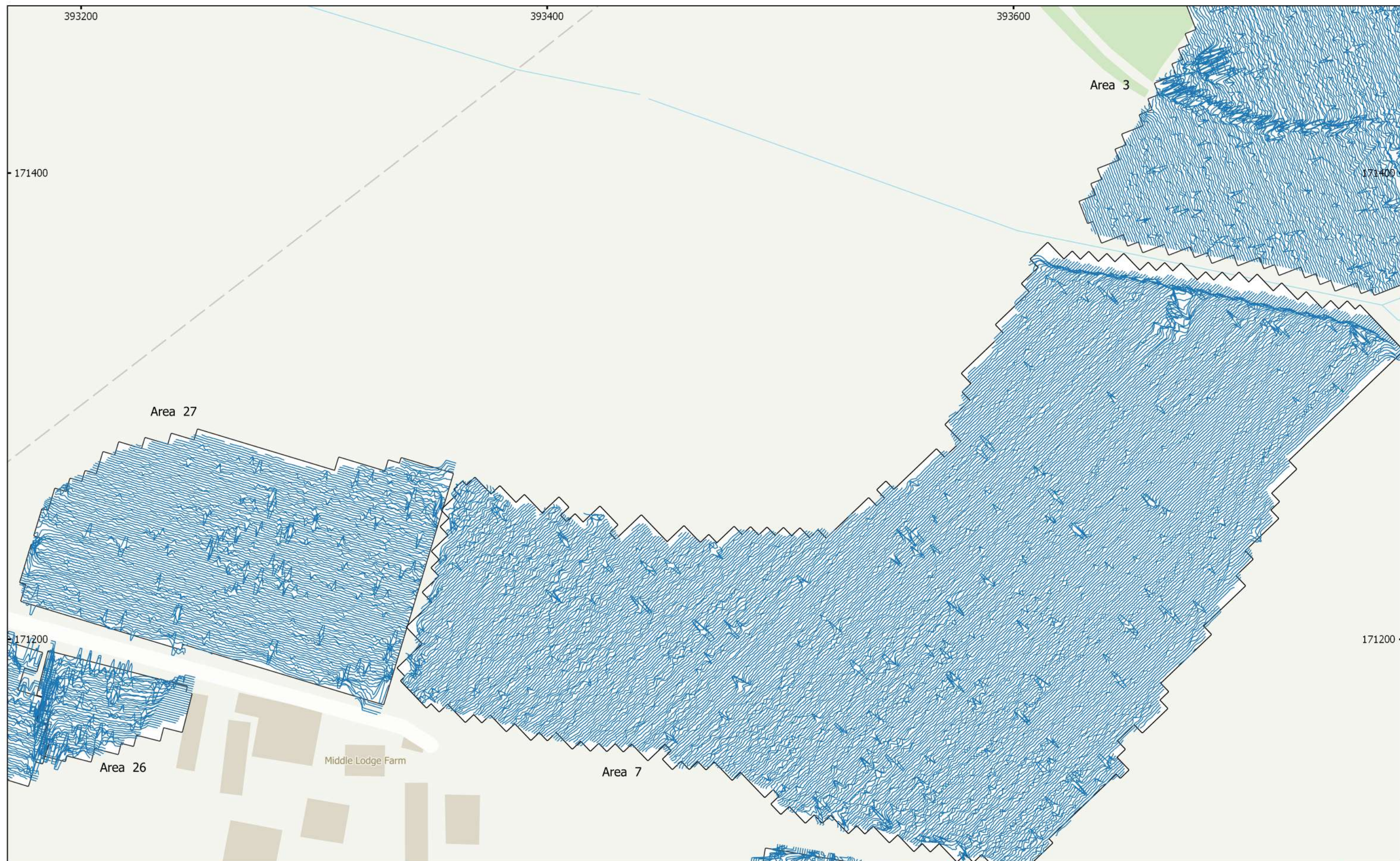




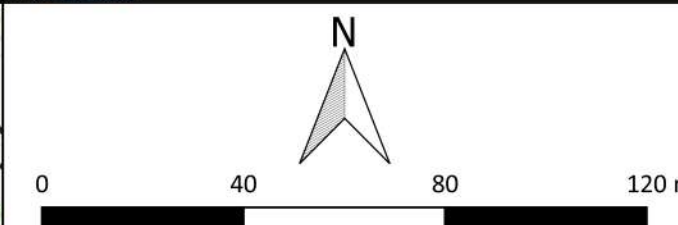
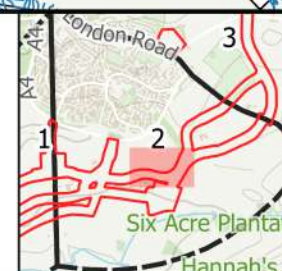
MSST732 - Future Chippenham Planning Road  
 Figure 25 - Magnetic Interpretation (Areas 3, 7, 25, 26 & 27)  
 1:1,500 @ A3  
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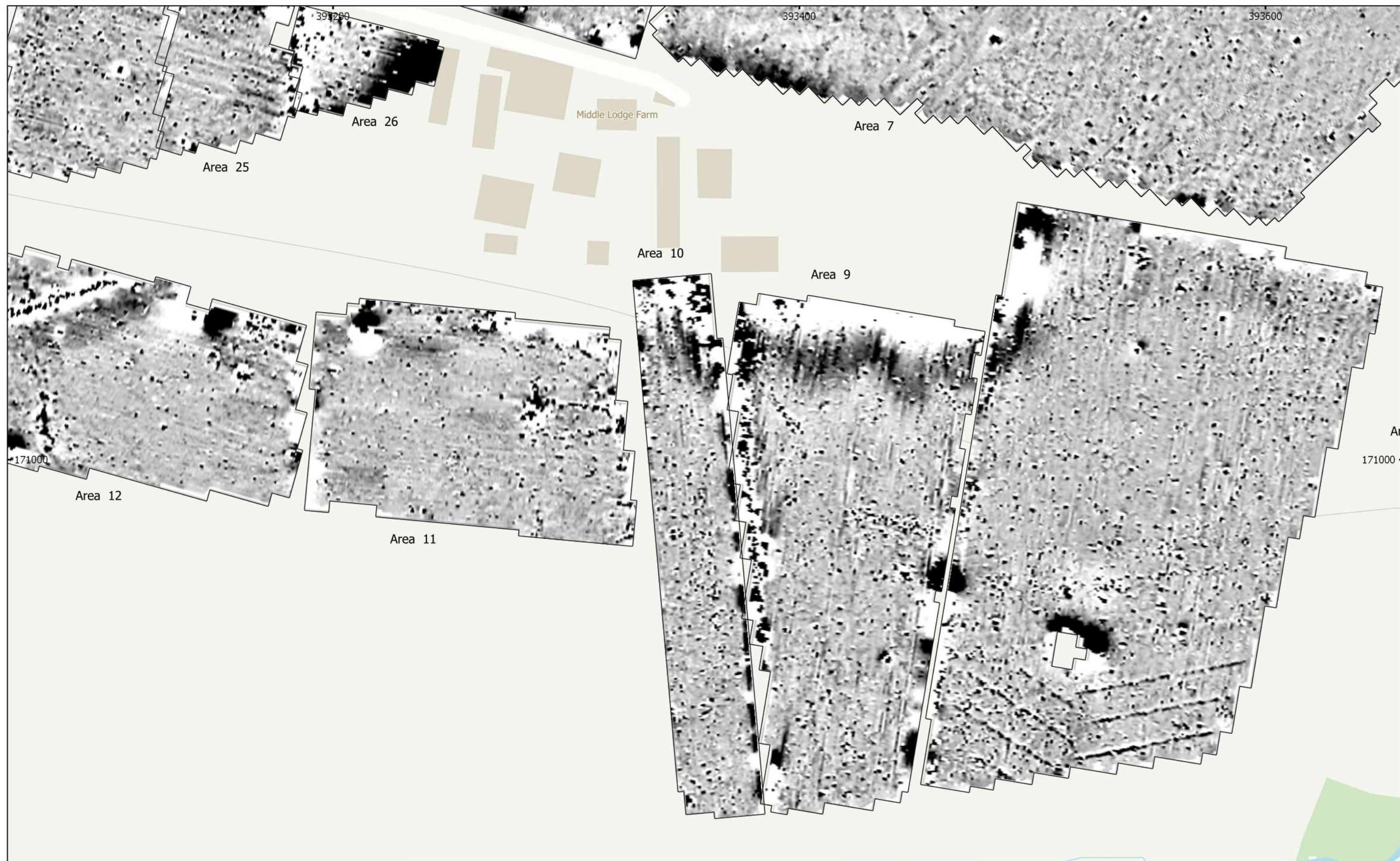
- |                               |                         |                          |
|-------------------------------|-------------------------|--------------------------|
| Archaeology Possible (Strong) | Natural (Zone)          | Agricultural (Trend)     |
| Archaeology Possible (Weak)   | Magnetic Disturbance    | Ridge and Furrow (Trend) |
| Modern/Industrial             | Ferrous/Debris (Spread) | Drainage Feature         |
| Natural (Weak)                | Undetermined (Strong)   | Ferrous (Spike)          |
|                               | Undetermined (Weak)     |                          |



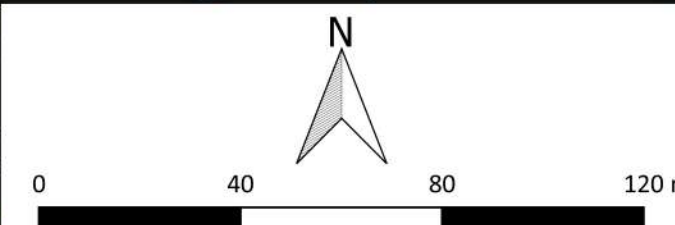
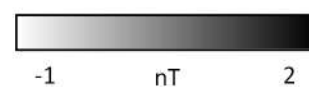


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Figure 26 - XY Trace Plot (Areas 3, 7, 25, 26 & 27)  
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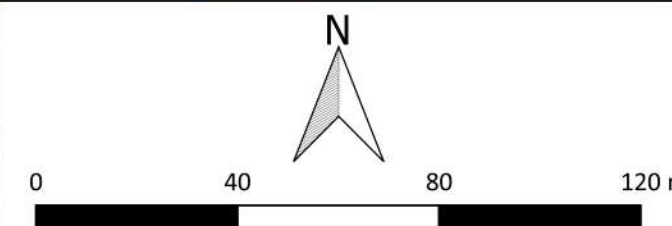
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 Figure 27 - Magnetic Gradient (Areas 7, 8, 9, 10, 11, 12, 25 & 26)  
 1:1,500 @ A3  
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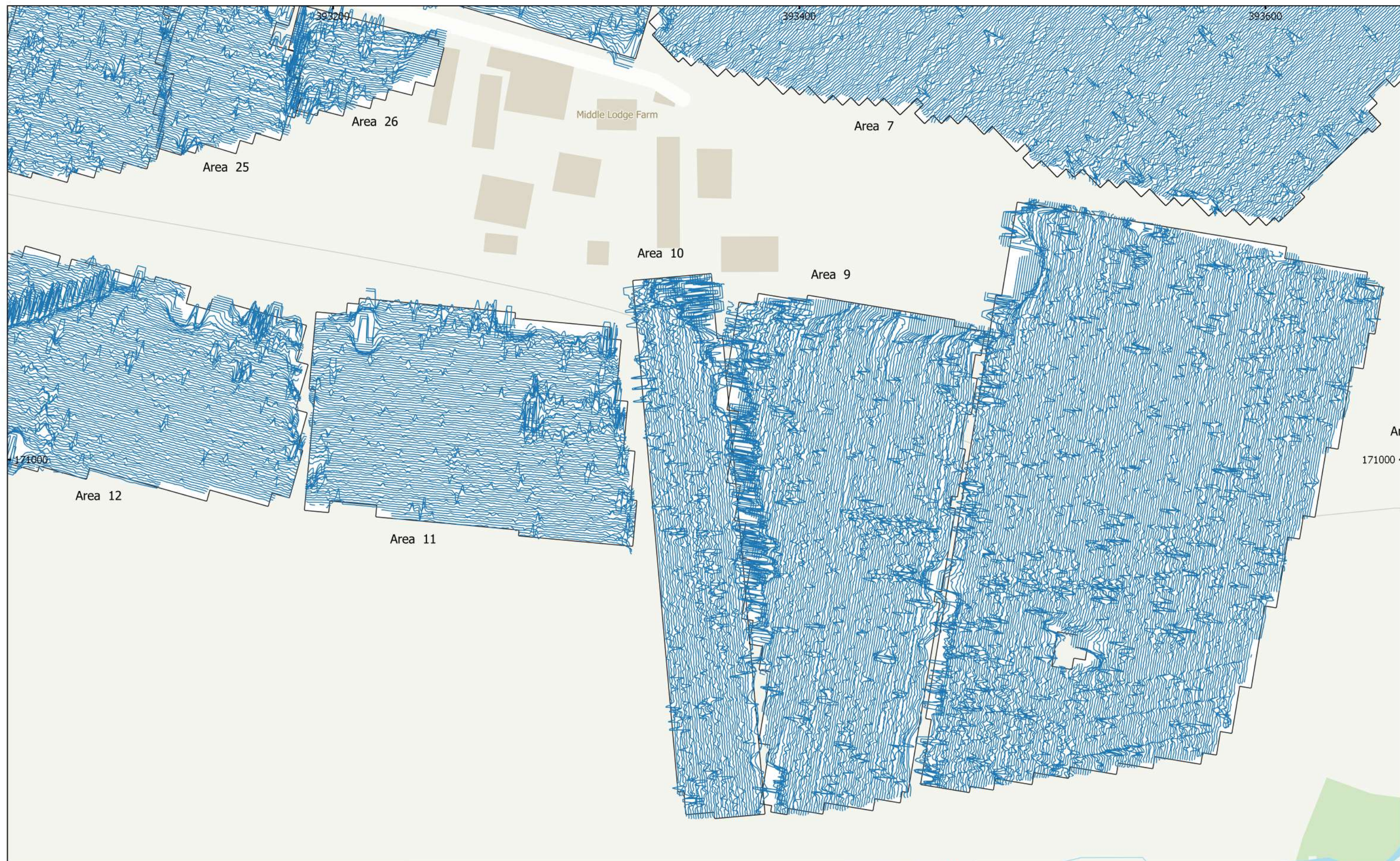




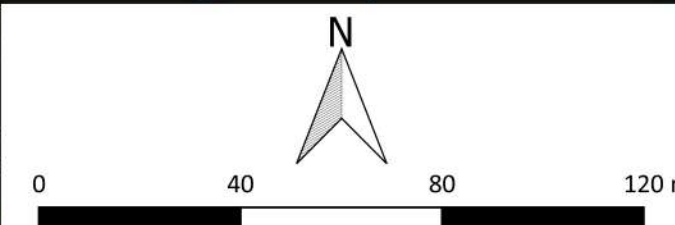
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 Figure 28 - Magnetic Interpretation (Areas 7, 8, 9, 10, 11, 12, 25 & 26)  
 1:1,500 @ A3  
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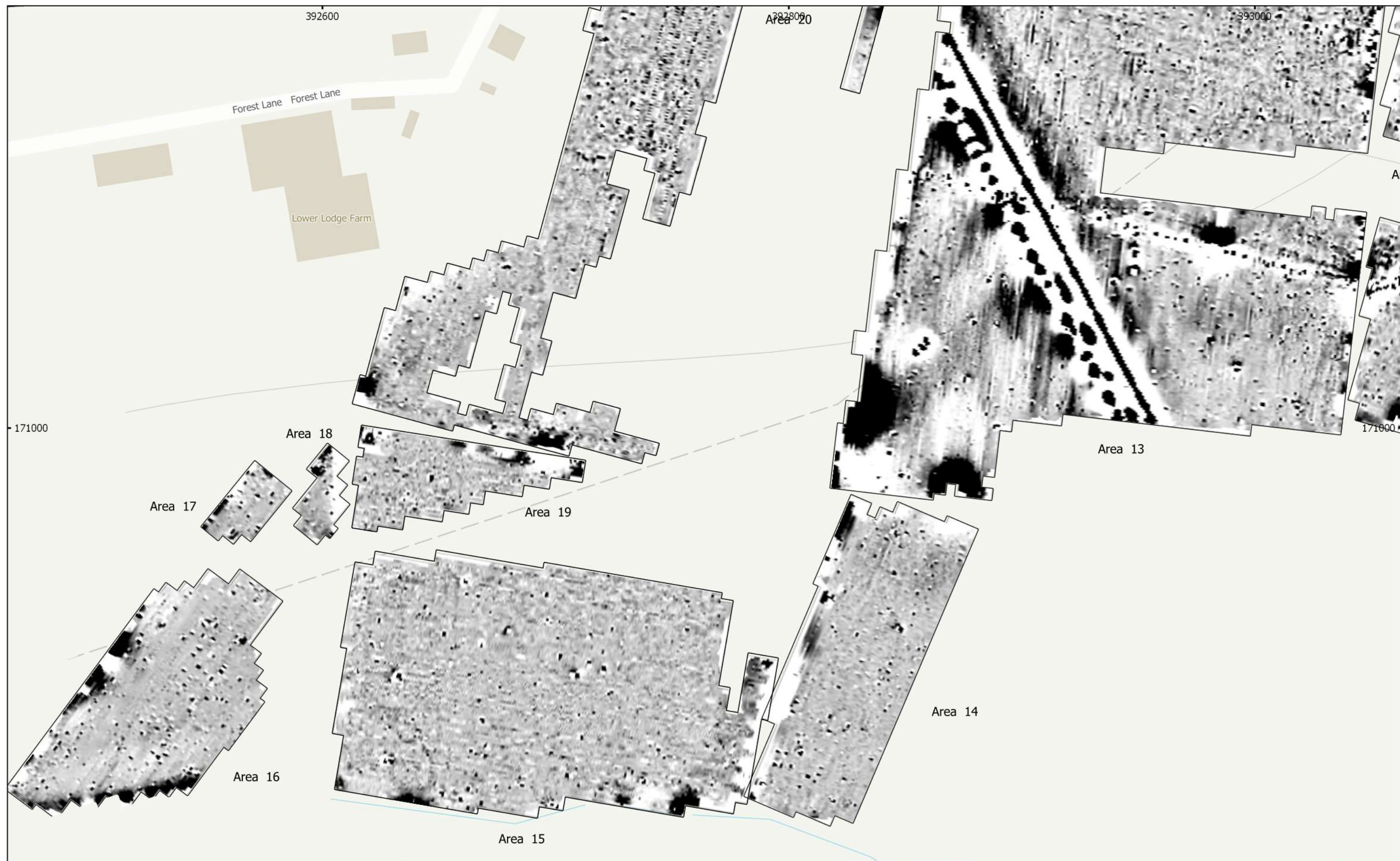
- |                      |                         |                          |
|----------------------|-------------------------|--------------------------|
| Natural (Strong)     | Ferrous/Debris (Spread) | Ridge and Furrow (Trend) |
| Natural (Weak)       | Undetermined (Weak)     | Drainage Feature         |
| Natural (Zone)       | Agricultural (Trend)    | Ferrous (Spike)          |
| Magnetic Disturbance | Service                 |                          |



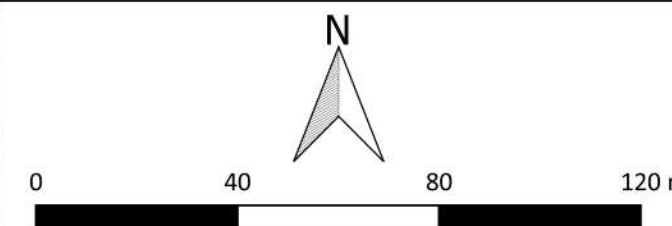
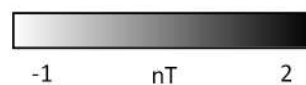


MSST732 - Future Chippenham Planning Road  
 Figure 29 - XY Trace Plot (Areas 7, 8, 9, 10, 11, 12, 25 & 26)  
 30nT/cm at 1:1,500 @ A3  
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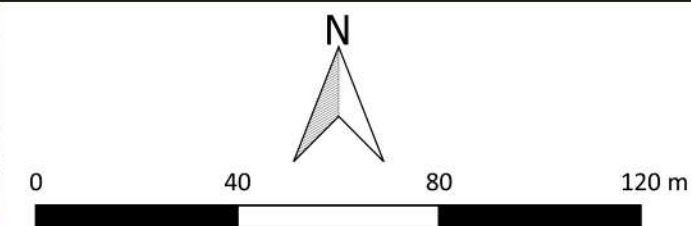


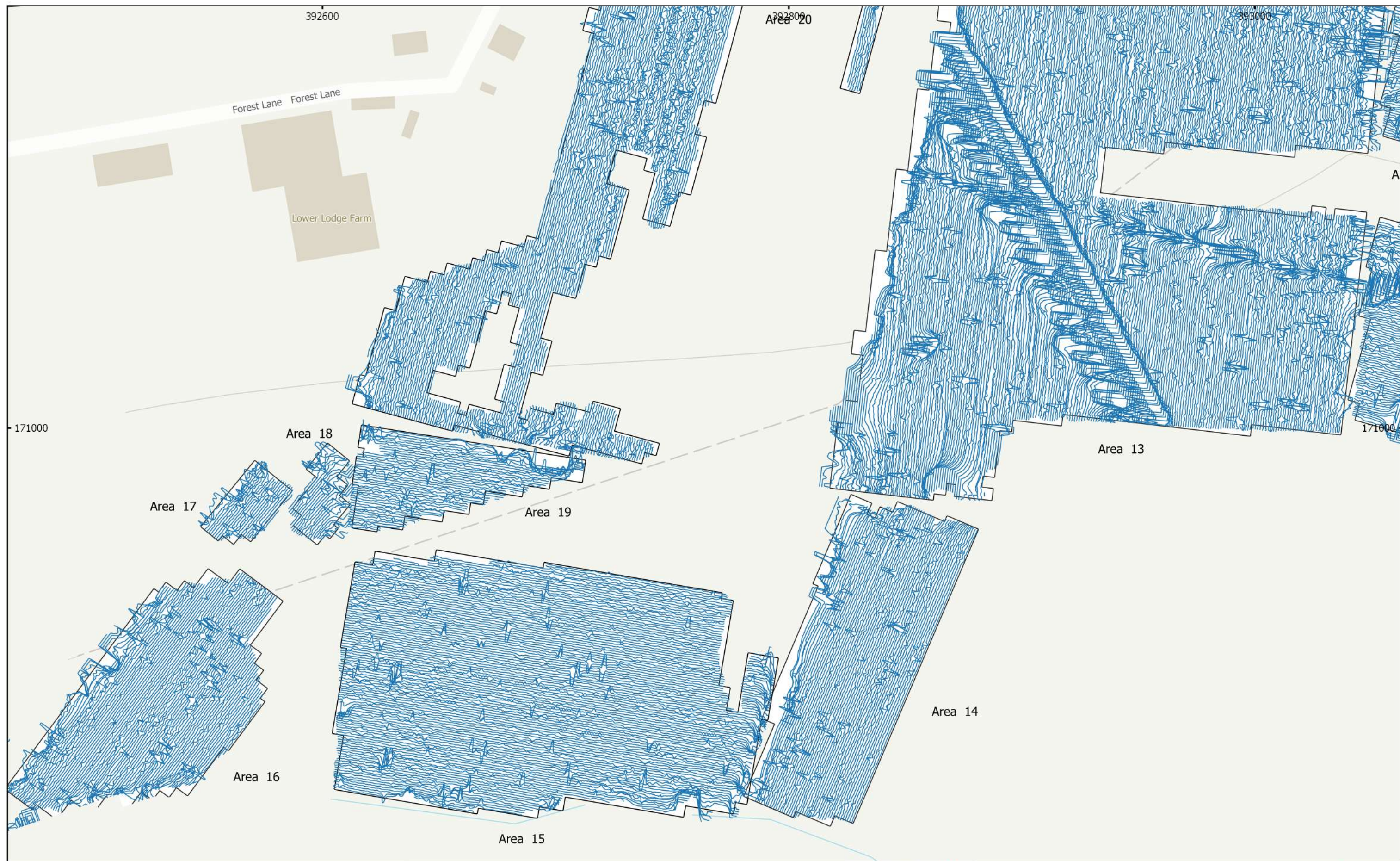
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 Figure 30 - Magnetic Gradient (Area 13, 14, 15, 16, 17, 18, 19 & 24)  
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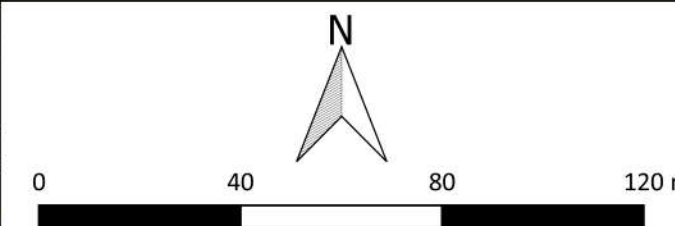


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 Figure 31 - Magnetic Interpretation (Area 13, 14, 15, 16, 17, 18, 19 & 24)  
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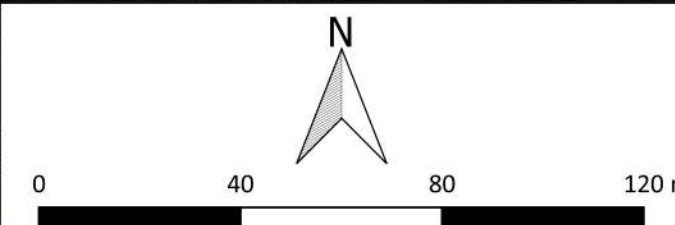
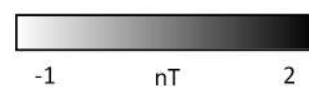


MSST732 - Future Chippenham Planning Road  
 Figure 32 - XY Trace Plot (Area 13, 14, 15, 16, 17, 18, 19 & 24)  
 30nT/cm at 1:1,500 @ A3  
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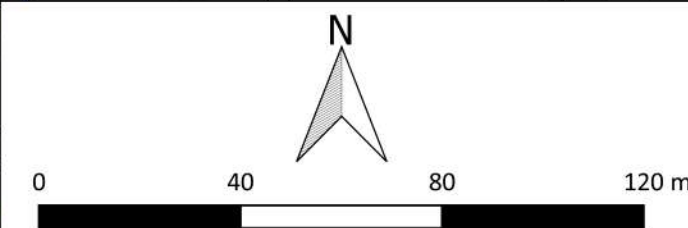
MSST732 - Future Chippenham Planning Road  
 Figure 33 - Magnetic Gradient (Area 13, 20, 21, 23, 24, 25, 26 & 27)  
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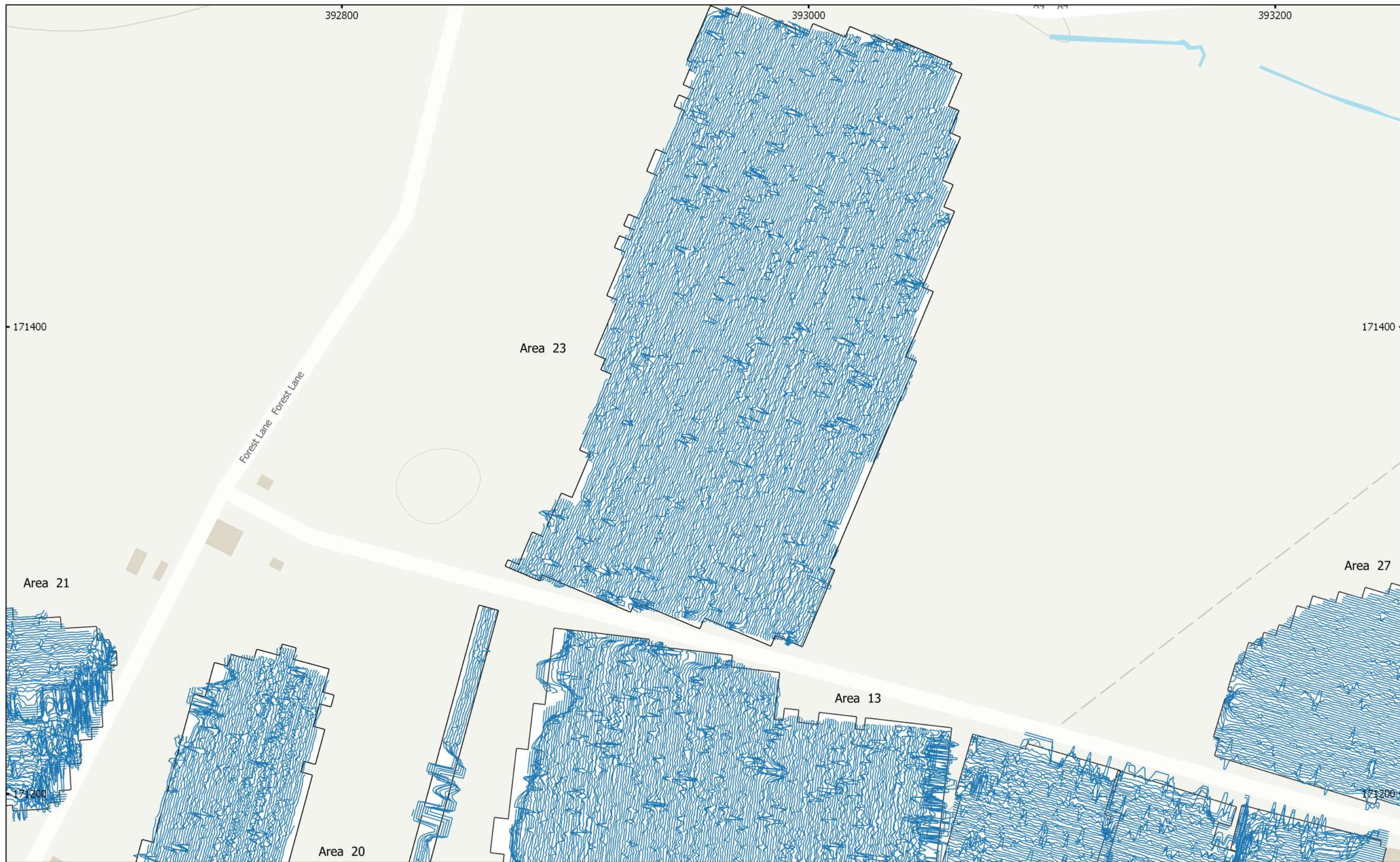




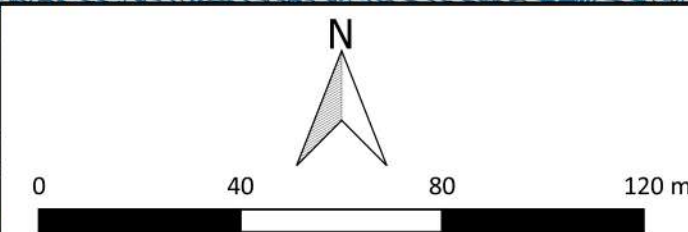
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 Figure 34 - Magnetic Interpretation (Area 13, 20, 21, 23, 24, 25, 26 & 27)  
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- |                      |                         |                          |
|----------------------|-------------------------|--------------------------|
| Agricultural (Weak)  | Ferrous/Debris (Spread) | Service                  |
| Natural (Weak)       | Undetermined (Weak)     | Ridge and Furrow (Trend) |
| Natural (Zone)       | Agricultural (Trend)    | Drainage Feature         |
| Magnetic Disturbance | Data Artefact           | Ferrous (Spike)          |



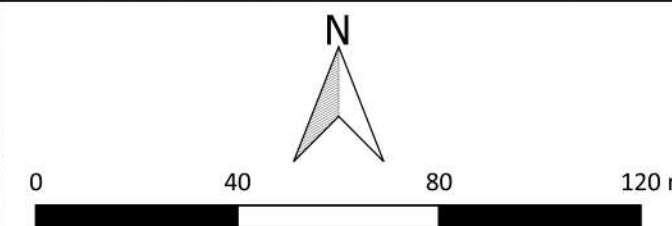
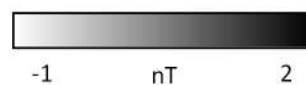


MSST732 - Future Chippenham Planning Road  
 Figure 35 - XY Trace Plot (Area 13, 20, 21, 23, 24, 25, 26 & 27)  
 30nT/cm at 1:1,500 @ A3  
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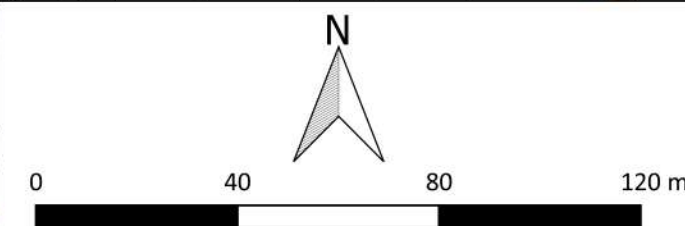
MSST732 - Future Chippenham Planning Road  
 Figure 36 - Magnetic Gradient (Areas 13, 20, 21, 22 & 23)  
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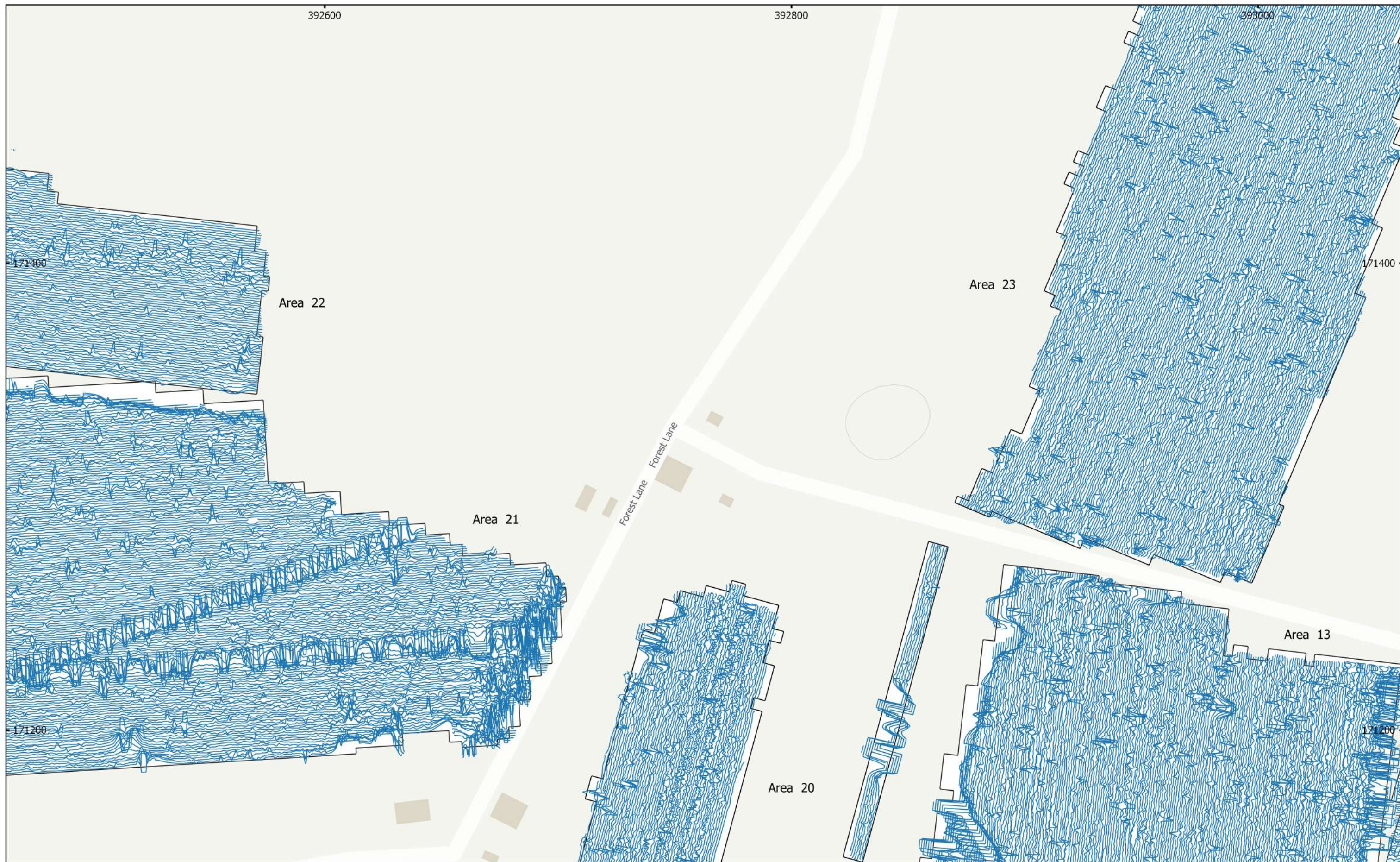




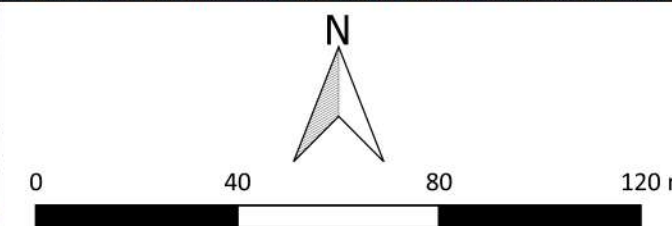
MSST732 - Future Chippenham Planning Road  
 Figure 37 - Magnetic Interpretation (Areas 13, 20, 21, 22 & 23)  
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- |                               |                         |                          |
|-------------------------------|-------------------------|--------------------------|
| Archaeology Possible (Strong) | Magnetic Disturbance    | Data Artefact            |
| Archaeology Possible (Weak)   | Ferrous/Debris (Spread) | Service                  |
| Agricultural (Weak)           | Undetermined (Strong)   | Ridge and Furrow (Trend) |
| Natural (Weak)                | Undetermined (Weak)     | Drainage Feature         |
| Natural (Zone)                | Agricultural (Trend)    | Ferrous (Spike)          |

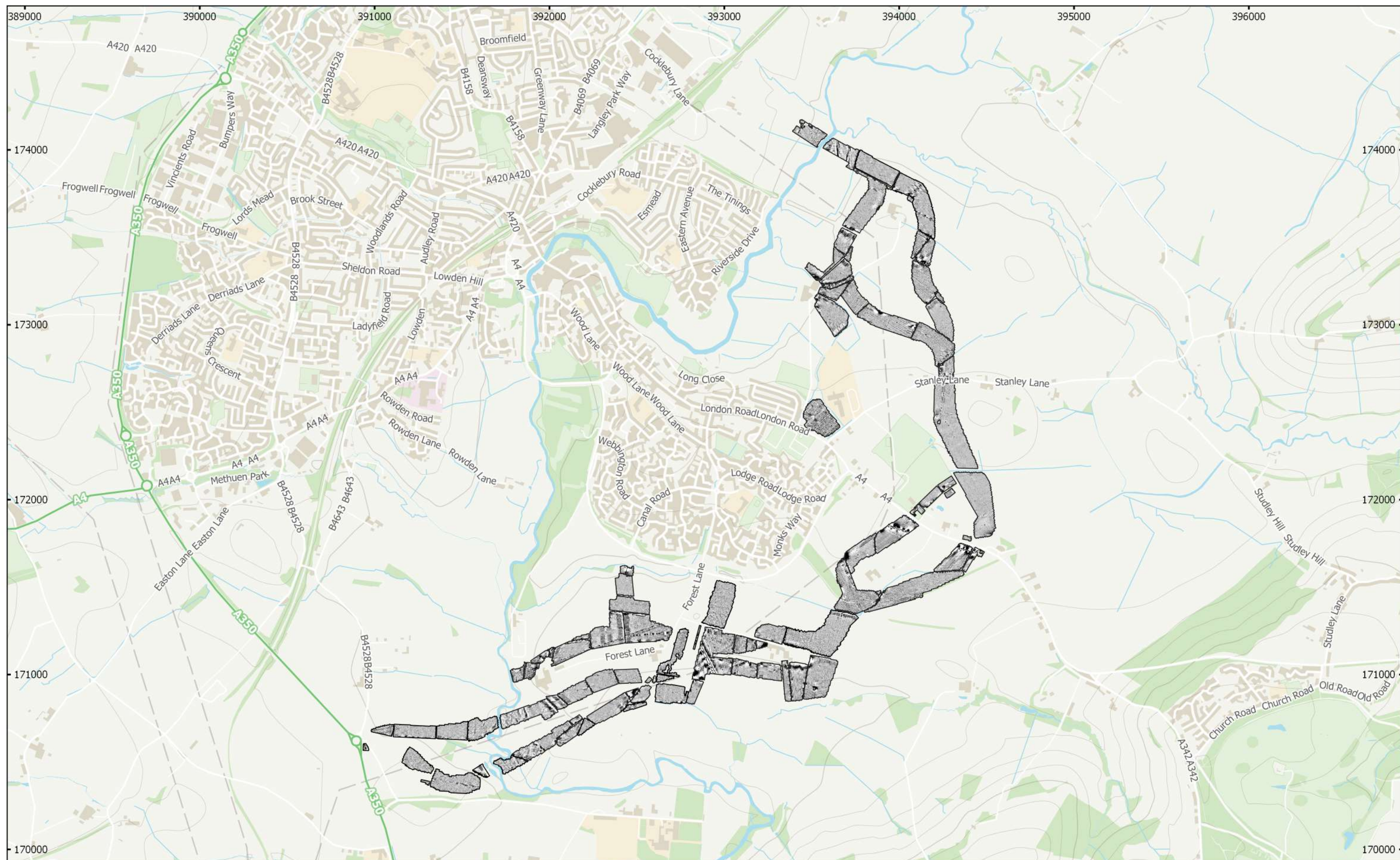




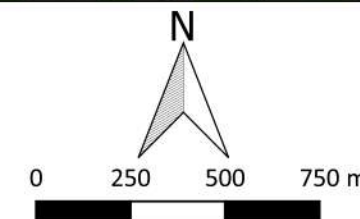
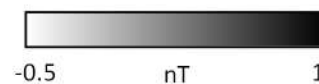
MSST732 - Future Chippenham Planning Road  
 Figure 38 - XY Trace Plot (Areas 13, 20, 21, 22 & 23)  
 30nT/cm at 1:1,500 @ A3  
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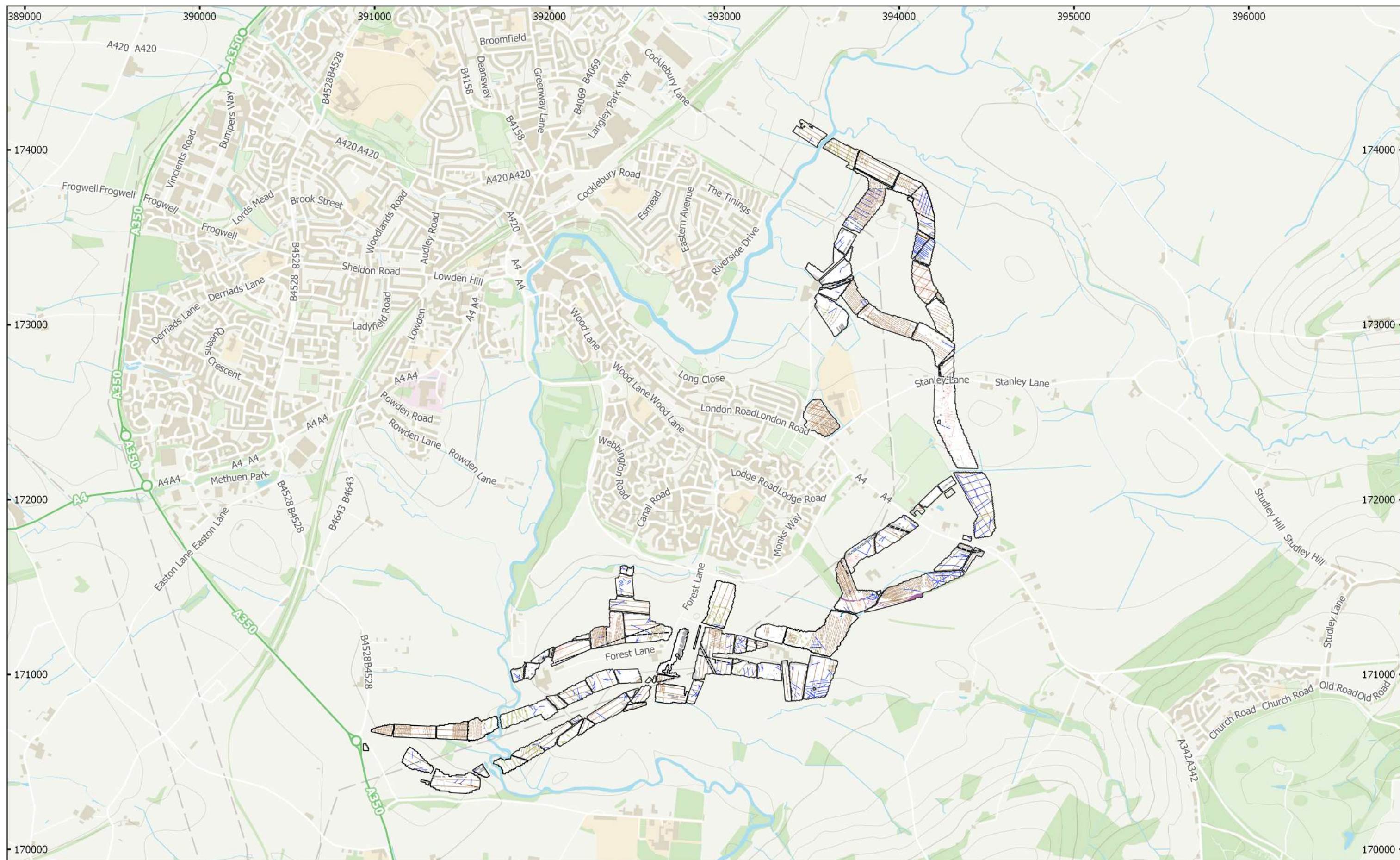






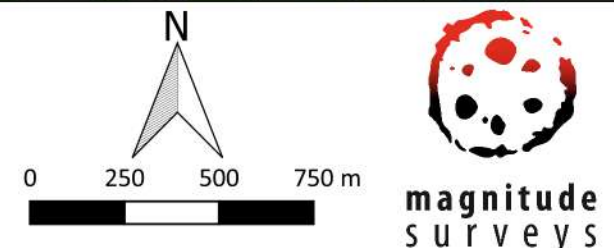
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 Figure A2- Full Overview Magnetic Gradient  
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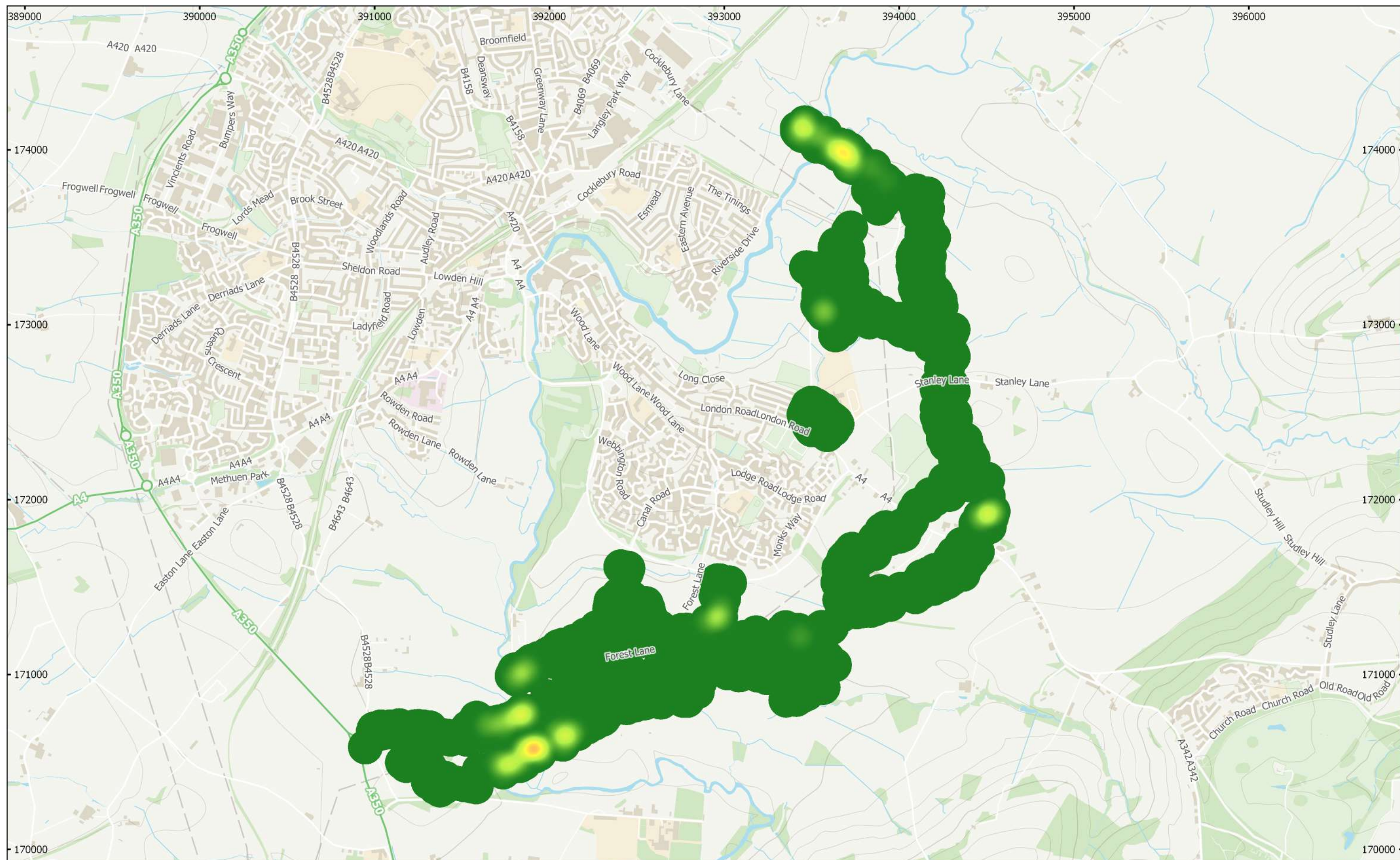


MSST732 - Future Chippenham Planning Road  
 Figure A3- Full Overview Interpretation  
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- |                                                                     |                                                             |                                                              |                                                               |
|---------------------------------------------------------------------|-------------------------------------------------------------|--------------------------------------------------------------|---------------------------------------------------------------|
| <span style="color: red;">■</span> Archaeology Probable (Strong)    | <span style="color: brown;">■</span> Agricultural (Strong)  | <span style="color: grey;">■</span> Magnetic Disturbance     | <span style="color: brown;">—</span> Agricultural (Trend)     |
| <span style="color: red;">■</span> Archaeology Probable (Weak)      | <span style="color: brown;">■</span> Agricultural (Weak)    | <span style="color: teal;">■</span> Undetermined (Strong)    | <span style="color: brown;">—</span> Ridge and Furrow (Trend) |
| <span style="color: orange;">■</span> Archaeology Possible (Strong) | <span style="color: green;">■</span> Natural (Strong)       | <span style="color: teal;">■</span> Undetermined (Weak)      | <span style="color: blue;">—</span> Drainage Feature          |
| <span style="color: orange;">■</span> Archaeology Possible (Weak)   | <span style="color: green;">■</span> Natural (Weak)         | <span style="color: blue;">—</span> Undetermined (Trend)     | <span style="color: grey;">—</span> Data Artefact             |
| <span style="color: purple;">■</span> Modern/ Industrial            | <span style="color: green;">■</span> Natural (Zone)         | <span style="color: black;">---</span> Service               |                                                               |
|                                                                     | <span style="color: grey;">■</span> Ferrous/Debris (Spread) | <span style="color: black;">---</span> Overhead Cable Effect |                                                               |







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 Figure A5- Full Overview Risk Potential of Palaeo Features  
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