

# Dissertation project

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Geophysical survey methods applied to the fields east and south-west of the church of St Cosmus and St Damian, Blean, Kent, conducted to establish the archaeological potential of the area and to evaluate existing information: survey results and their interpretation.

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## **1. Introduction**

- 1.1.** Magnetometry and resistivity survey were conducted in two fields east of the village of Blean in the Parish of St Cosmus and St Damian in the Blean, Kent (TR 119608) approximately 2.4 miles north along the A290 Whitstable Road from the city of Canterbury, Kent, a UNESCO World Heritage Site and are shown on figures 1-3. The survey area overlooks and forms the cusp and downward slope of the north side of the valley facing south towards Canterbury. The fields lie to the east (Field 1) and south-west (Field 2) of the church of St Cosmus and St Damian the location of which is shown in figure 4. Figure 5 shows a highlighted plan of the survey areas on Ordnance Survey map data. Through the valley runs the Sarre Penn tributary of the Great Stour. The land is privately owned by the University of Kent and is currently leased for farming to Mr Neil Strand.
- 1.2.** Field 2 contains an area designated as a scheduled monument by Historic England (scheduled monument list entry number: 1018785) (further details and highlighted area on figure 6).
- 1.3.** The Sarre Penn stream runs east-west approximately 187m south of the southernmost point of Field 1 and a tributary stream runs north-south through the woods at the eastern boundary.
- 1.4.** Field 1 (NGR centre point TR 12874 60619) is bounded on the north by hedges and the south by a combination of hedges and mature trees. The western boundary consists of mature trees and the ‘Crab and Winkle Path’, previously known as the ‘Salt Road’ which follows the path of a Roman road that ran from Canterbury to Seasalter on the coast (Wheaten and Birmingham 2008, 34). The path runs along the western edge of the field and is part tarmacked/part metalled. The field survey area is highlighted in figure 7. The field survey areas for Field 2 are highlighted in figure 8 which is bounded to the east and west by hedges and the south by hedges and mature trees. The churchyard occupies the north-east corner of the field (not included in the survey area) and bordered by a metal fence and dense brambles and bushes occupying the ‘moated’ area shown in part in figure 9. The north boundary consists of a barbed-wire fence with wooden posts, the other side of which is a tarmacked car park as shown in figure 10.

- 1.5.** Field 1 is arable farmland, regularly ploughed with an even till and no challenging obstacles, furrows or animal burrows. As shown in figure 11, the crop of wheat had recently been cut leaving stubble over the whole area. Field 2 is unimproved grassland with no record of fertilising or grazing since the current owners purchased the land in 2005 and has been left to scrub and occasional mowing for silage, the conditions of the field can be seen in figure 12. The weather remained dry during most of the survey of Field 1 with occasional light winds and rain on two days. The weather for the Field 2 survey was rainy for approximately 45% of the time with one day of severe gales and temperatures varying from 2 degrees to 11 degrees.
- 1.6.** Two trees are located in the middle of Field 2, one prevented the completion of the survey due to being surrounded by thick brambles as is clearly seen in figure 13. Overhead cables cross Field 2 from two directions. Electricity cables run from north-northeast to south-south west and telephone cables run from east-north-east to north-west of the middle of the field. Two poles are located in the field supporting the electricity lines and the telegraph lines are anchored at a point near the one pole that supports them as can be seen in figure 14. All these services and trees were GPS plotted and are shown on figure 15.
- 1.7.** The geology in both fields is London Clay strata with superficial Head deposits in a subaerial slope setting (British Geological Survey materials © NERC). The soil type is Luvisols, freely draining, slightly acid, loamy soil (Cranfield University 2018). The wooded areas around Blean are of a heavy, acidic nature, unsuitable for arable production which may indicate deliberate clearance of the area targeted for the survey as a more centralized arable area in the past due to more favourable conditions. The bedrock is chalk which leads to a ‘perched water table on the London clay’ resulting in a high-water table (Jacobs 2012, 10).
- 1.8.** There are no records of archaeological excavations in Field 1 and no previous geophysical survey has been undertaken to the author’s knowledge. There are extensive cropmarks of differing clarity visible from aerial photographs depending on the date of the image, the conditions and the crop (see section 5.4). Previous investigations of Field 2 have included fieldwalking (St. Clair-Terry 1986) and magnetometer survey (Bosworth 2009, unpublished). Earthworks have been recorded on Ordnance Survey multimaps vector layers and are visible on contour data derived from LiDAR images, these are discussed further in section 5.5 and are shown in figure 16.

- 1.9.** The fieldwork was carried out by the author under guidance from Lloyd Bosworth, Archaeological Technician at the University of Kent and assistance from volunteers from the student community and the general public. The report was compiled in April 2018.

## **2. Project aims**

- 2.1.** Archaeological geophysics is defined as ‘the examination of the Earth’s physical properties using non-invasive ground survey techniques to reveal buried archaeological features, sites and landscapes’ (Gaffney and Gater 2003, 12). The original project design was to investigate Field 1 east of St Cosmus and St Damian in the Blean Church using geophysical methods of magnetometry and resistivity in order to better understand the archaeological potential of the area and compare the results with existing evidence from cropmarks. A hermeneutic (Hodder 1999, 32) approach to the interpretation of the site resulted in the decision to extend the survey to include the adjacent Field 2 as this may aid in the interpretation of the results from Field 1. The north of Field 2’s listing as a scheduled monument had already indicated an area of archaeological interest and presented an additional opportunity to expand the understanding of the archaeology of that area and compare the survey methods with further existing evidence from topography and fieldwalking. The survey results from both fields are to be interpreted alongside the other sources of information in order to provide contextual interpretation and evaluate the various methods by which archaeology can be identified at this site. These sources include historical texts, fieldwalking, aerial photography topography and anecdotal information. The final conclusion considers how much the geophysical survey method has improved or refuted the understanding of the site before the survey was undertaken and how further methods can contribute to better understanding.

## **3. Methodology**

### **3.1. Dates**

- 3.1.1.** The magnetometry survey in Field 1 was conducted from 20th September to 8th October 2017.
- 3.1.2.** Magnetometry and resistivity surveys were conducted in Field 2 from 9<sup>th</sup> January to 3<sup>rd</sup> February 2018.

### **3.2. Rationale**

- 3.2.1.** Both magnetometry and resistivity methods were successfully employed at Cottam, Yorkshire to produce a map of sub-surface anomalies of a settlement area defined through aerial photography (Garner-Lahire 2015, 17). Due to the size of the survey area for this project and extent of the potential features identified through other evidence it was decided that magnetometry was the best method of non-intrusive investigation to cover both Field 1 and Field 2. Aerial images of Field 1 (see section 5.4) indicating circular anomalies and field systems such as enclosure ditches and boundaries indicated that resistivity would have been less suitable due to time constraints. Limitations in the time and resources available measured against the size of the survey must be balanced, with the magnetic method being the most sensible and economical for sites without evidence of stone buildings (Clark 1990, 128). Both magnetometry and resistivity were conducted in Field 2; magnetometry was conducted due to the size of the site, to provide comparative data with Field 1 and to assess its effectiveness against the eventual resistivity results and current knowledge; resistivity was conducted to assess the method in comparison to magnetometry and due to the potential for Roman and medieval buildings derived from material found in the fabric of the oldest part of the church and fieldwork carried out in the past (St. Clair-Terry 1986) (see section 7.3).

### **3.3. Permissions**

- 3.3.1.** Facilitation was required from third parties to conduct the surveys. Permission was sought from the landowner (University of Kent) which required further negotiation with the tenant farmer (Mr Neil Strand) to establish a deadline window of three weeks to complete the survey from 16th September 2017 to 8th October 2017 in Field 1 and an open-ended deadline for Field 2 starting from 9th January. A licence was also required to conduct surveys in Field 2 due to its designation as a Scheduled Monument under the Ancient Monument and Archaeological Areas Act 1979 (Historic England 2018) (appendix 1).

### **3.4. Volunteers**

- 3.4.1.** In order to ensure the survey was completed within the allotted time frame, volunteers from the University of Kent and the wider public were recruited through advertisements on Facebook pages such as the Kent Classics and Archaeology Society and community groups such as Cobham Landscape Detectives and the Isle of Thanet Archaeological Society. Lecturers at the University of Kent and Canterbury Christ Church University also informed

their students of the volunteering and learning opportunity, the opportunity for students to learn about the equipment and method would assist them in their studies and provide the author with an efficient body of helpers.

**3.4.2.** Volunteers were required to read and sign a risk assessment form before undertaking fieldwork (appendix 2).

**3.4.3.** Volunteers were primarily recruited to assist in moving ropes and washing lines from the east and west ends of one grid to another in order that the operator could continue to walk the traverses without having to reorganise the grids and to move cones after each traverse.

### **3.5. Local impact**

**3.5.1.** The vicar of the parish church was informed in order to prepare the local community prior to the Field 1 survey. However, it appeared that many residents were still unaware of the work being conducted and the reasons for it. The sight of surveyors in the field caused concern for local residents and to mitigate any negative impact due to suspicion of preparing for building activity, volunteers were instructed to respond to those concerns in a sensitive manner. Reflecting on this impact, the church was contacted prior to the survey carried out in Field 2 and a poster produced (appendix 3). This was displayed prominently in public areas around the site and many local residents showed an interest in the project. The author has been asked to present the results to various local groups later in the year.

### **3.6. Magnetometry**

**3.6.1.** A full technical description of the magnetometry methodology is provided in appendix 4.1.1.

**3.6.2.** In Field 1 a total of 90 full 30m x 30m grids were set out and 38 partial grids. In Field 2 a total of 21 full 30m x 30m grids were set out and 15 partials.

**3.6.3.** In Field 1 all 128 total and partial grids were surveyed across the site and 146 in total were walked due to re-surveying of some squares. In Field 2 a total of 16 full 30m x 30m grids and 11 partials were walked due to obstacles such as brambles and trees and time constraints.

**3.6.4.** A partial grid at the north of area A was surveyed incorrectly, possibly due to ferrous material being carried by the operator as at Sheepwash Farm, Staffordshire (Payne and Pearce 2017, area 2 [m13]). An attempt to revisit the grid at the end of the survey was unsuccessful due to agricultural machinery parked in the grid (fig. 20)

### **3.7. Resistivity**

**3.7.1.** A full technical description of the resistivity methodology is provided in appendix 4.1.2.

**3.7.2.** A total of nine grids were walked 7 full 30m x 30m grids and two partials.

### **3.8. Data processing**

**3.8.1.** A full description of the data processing methodology is provided in appendix 4.2.

### **3.9. Results**

**3.9.1.** Due to the size of the survey areas, the use of two geophysical methods and the number of anomalies present a labelling convention has been applied to assist when reading the interpretation and referring to the features on the graphical representations:

- Magnetometry results - cut features such as ditches and gullies – single number e.g. [9]
- Magnetometry results - significant dipolar and monopolar features – letters only e.g. [AB]
- Resistivity results – letter and number – e.g. [D1]

**3.9.2.** Due to the large number of small discrete monopolar and dipolar anomalies the author has chosen to describe only the largest and those associated with other archaeological features. Where small anomalies form significant patterns or clusters, they are not labelled but still discussed below and visible as ‘points’ on the graphical representations.

**3.9.3.** In order to avoid features being obscured on certain graphical interpretations and to offer more choice to the reader, multiple versions of some graphical representations of the survey have been made available. All figures, including those referenced in this report and its appendices, are listed in an annexe and can be viewed according to the reader’s preference.

## 4. Results

### 4.1. Magnetometry survey

**4.1.1.** A full list of the features identified from the magnetometer survey results from Field 1 (4.1.2) and Field 2 (4.1.3) has been compiled for ease of reference. Archaeological features are highlighted as blue, potential archaeological features as pink, dipolar features as yellow outlines and monopolar features as red outlines. The same colour key is used in the graphical representations of all the interpretation plans of the magnetometry results.

#### 4.1.2. Field 1 (Figures 26-37)

##### 4.1.2.1. List of anomalies

Anomaly number	Description of anomaly	Report area
1	Semi-circular feature, 30m diameter, truncated by the modern pathway	A
2	Semi-circular feature 50m diameter truncated by the modern path, following the same pattern as feature 1	A
3	SW-NE running linear feature, over 140m long	A
4	NW-SE running linear anomaly, 90m long	A
5	NW-SE running linear feature, 100m long possibly associated with feature 62	A
6	A substantial right-angled linear feature, approximately 200m long extending from Field 2, forms a trapezoidal shape with linear features 26 and 15	A
7	A series of linear anomalies, 180m long, forming a stepped shape and respecting feature 16. Encloses, with feature 23, a large area north of features 3 and 15 of approximately 1 hectare	A
8	NW-SE running linear feature, 45m long running parallel to feature 11	A



9	SW-NE running linear anomaly, 35m long running parallel to feature 15	A
10	NW-SE running curvilinear anomaly, 60m long	A
11	NW-SE running linear feature 130m long parallel to feature 3 and terminating at cluster of monopolar and dipolar anomalies	A
13	SW-NE running linear anomaly 40m long, forms part of a trapezoidal area with linear features 18, 23 and 35	B
14	N-S running linear anomaly, over 36m long passing monopolar anomaly P	A
15	SW-NE running linear feature, 175m long, running parallel to linear feature 3, meeting linear feature 23 at dipolar anomaly E	A
16	Circular feature of 30m diameter north of linear feature 12 and west of linear feature 19	A
17	NW-SE running linear anomaly, 285m long,	A, B, E
18	NW-SE running linear anomaly, 60m long, forming trapezoidal shape with linear features 13 and 35, intersecting with linear 35 at dipolar anomaly G	B
19	NW-SE running curvilinear feature 105m long running parallel to features 20 and 23, terminating at north-west end to allow for entranceway into platformed area and at linear feature 3 at south-east end	A
20	NW-SE running curvilinear feature, 120m long, parallel with linear features 19 and 23, terminating at north-west end to allow for entranceway into platformed area and terminating at linear feature 3 at south-east end	A
21	Right angled linear feature over 75m long, NW-SE part parallel with linear feature 20, SW-NE length parallel with linear feature 23	B

23	SE-NW running curvilinear feature, over 100m long, parallel with linear feature 21 forming trapezoidal shape with linear features 23, 35 and 29, running through dipolar anomaly F	B
25	SW-NE running linear anomaly, over 80m long	A
26	Substantial N-S running linear feature 90m long. forming a large, roughly trapezoidal enclosed area, meeting linear 6 at the south end, very clear response	A
27	NW-SE running linear anomaly, over 105m long	A
28	NW-SE linear feature, over 85m long, forms multiple trapezoidal shaped areas with features 35, 18, 36, 37, 23 and 20	B
29	NW-SE linear feature, 110m long	E
30	NW-SE linear anomaly, 110m long.	A
31	SE-NW running curvilinear feature, over 100m long, parallel with linear features 19 and 20, forming trapezoidal shapes with linear features 23, 35, 13 and 18, terminating at intersection with linear feature 15 and dipolar anomaly E	A, B
33	Curvilinear feature, 90m long possibly part of large circular feature 50m in diameter	C
34	Oval-shaped anomaly, 25m long	C
35	SE-NW running linear anomaly, 125m long, running from linear feature 23 to circular feature 40 and through dipolar feature G, forms multiple trapezoidal-shaped areas with linear features 23, 31, 13, 18, 28 and 36	B
36	SW-NE running linear feature of over 60m, running from linear feature 28 to circular feature 40, forms trapezoidal-shaped areas with linear features 35, 37 and 28	B, C

37	SW-NE running stepped linear feature, running from linear feature 28, forms trapezoidal-shaped area with linear features 28 and 36	B
38	SE-NW running short, linear feature running into circular feature 40	C
39	Circular feature, 15m in diameter, respected by linear feature 42	C
40	Circular feature 50m in diameter	C
41	SE-NW running linear anomaly, 125m long, running from linear feature 23 to circular feature 40 and through dipolar feature G, forms multiple trapezoidal-shaped areas with linear features 23, 31, 13, 18, 28 and 36	D, E
42	NW to SW linear feature over 175m extending from circular feature 40, respecting circular feature 39	C, D
43	Semi-circular feature, 22m in diameter	D
44	Interrupted NW-SE linear feature, 14m long, running through semi-circular feature 43	D
45	NW-SE running linear feature, 90m long, south-west of semi-circular feature 43	D
46	Sub-oval anomaly, 50m long	E
47	NW to SE linear anomaly 140m long	E
A	Discrete, dipolar anomaly, 6m diameter, between linear features 19 and 20	A
B	Discrete, dipolar anomaly, 7.5m diameter, east of linear feature 31 and north of linear feature 13	B
C	Cluster of discrete oval-shaped dipolar anomalies ranging in size from 7m to 4m in diameter	E
D	Discrete, dipolar anomaly, 5m in diameter lying west of linear anomaly 27	A
E	Discrete oval-shaped anomaly, 5m in diameter at the intersection of linear features 31 and 15	A
F	Discrete, oval-shaped anomaly along the course of linear feature 23.	B

G	Discrete, oval-shaped dipolar anomaly, 9m long at intersection of linear features 35 and 18	B
H	Discrete, oval-shaped dipolar anomaly, 7m long along the course of linear feature 28	B
J	Oval-shape, dipolar anomaly, 5m diameter, in the centre of circular feature 40	C
K	Discrete, oval-shaped anomaly, 9m in diameter	D
L	Oval-shaped, dipolar anomaly, 5m in diameter, inside and at NW of semi-circular feature 43	D
P	Discrete, circular-shaped, monopolar anomaly, 4m in diameter, east of linear anomaly 14	A
Q	Discrete, sub-circular, monopolar anomaly, 4m in diameter, west of linear anomaly 27	A
R	Discrete, oval-shaped, monopolar anomaly, 15m long, NE of circular anomaly 40	C
S	Discrete, oval-shaped monopolar anomaly, 8m long, NE of circular anomaly 16, west of linear anomaly 19	A
T	Discrete, oval-shaped, monopolar anomaly, 7m long, NE of circular anomaly 16 and on the course of linear anomaly 19	A
U	Discrete, oval-shaped monopolar anomaly, 15m long, at the end of linear anomaly 19.	A
V	Discrete, oval-shaped monopolar anomaly, 4m long, located on linear feature 38 outside and SW of circular feature 40	C

#### 4.1.2.2. Initial interpretations by survey area

##### Area A (Figure 33)

Semi-circular features [1] and [2] encountered in Field 1 are likely to extend beyond the modern pathway into what is now the churchyard and may be related to the ‘moat’ that surrounds it. The strong negative response signified by the light area in these features could

be caused by the metal fence surrounding the churchyard at the western side of the modern path and appear to have caused a darkening in the grids immediately associated with it. Features [3] and [15] appear to be associated with the trackways that extend across Field 2 from west to east. The right-angled linear feature [6] also looks to be an extension of linear feature [63] present in Field 2 although earthworks in Field 2 following the eastern side of line [65] suggest that [63] may follow the line of the current boundary south and not cross into Field 1. It should be noted that the visible earthworks and feature may not be contemporary. Features [8] and [11] continue parallel to each other and feature [11] terminates at an area of heavily distorted readings coincident with a group of monopolar points in a sub-rectangular pattern 30m x 15m which may be postholes indicating a building of some kind. Linear feature [3], consistent with the holloway from Field 2, extends further east parallel to feature [15] and may comprise the north and south sides of a track. Despite the heavy magnetic disturbance in this part of the field the potential holloway feature clearly extends to the edge of the area demarcated by features [7] and [31]. The holloway feature may not simply be less perceptible east of the confluence with the N-S linear feature [31] which intersects at anomaly [E] it can therefore be interpreted as terminating at this point or forming part of a right-angled boundary with feature [31].

The platformed area in the north-west of area A and seen in figure 38 elicits particular attention due to its topography and the density of responses. Stepped feature [7] enters the survey area from the north west which is the garden of a modern house. The land that the feature surrounds is significantly elevated compared to the land east of linear [20] and south of linear [15] and can be clearly seen from the topographical model in figure 40. The survey results show evidence of continued and long-term use and occupation of this section of land due to the presence of numerous monopolar and dipolar anomalies similar to those at Beach's Barn, Wiltshire (Clark 2003, fig. 62). Another hypothesis for the raised topography of the area is that occupation was prevalent in this section of the field and continuous ploughing over the remainder of the area may have resulted in significant dispersal of the soil, in effect lowering the rest of the field. Circular feature [16] is again elevated in comparison with the surrounding topography, as can be seen from the contour model, and breaks in the circular pattern at the east of the feature may indicate an entrance suggestive of a settlement enclosure. This would be consistent with various monopolar points in a circular pattern in figure 33 which may be postholes for settlement buildings such as roundhouses. There are also monopolar features [S] and [T] to the north east which may be pits containing organic material associated further with settlement activity at feature [16]. As the platformed area displays many anomalies, caution should be employed when considering whether any of the anomalies in the area are associated with features that happen to be in the same

location. As discussed above, these may have occurred at different phases of occupation. Linear features [19], [20] and [31] could indicate a single boundary for the platformed area which has been recut over several phases in slightly different positions. Linear features [19] and [20] may alternatively form part of a south-running trackway at a right angle to the trackway formed by [21] and [23] or they may continue into the south part of the field in features [25], [26] or [27] indicating a larger enclosure.

Feature [31] forms a right angle with linear [23] becoming both the northern boundary of an enclosed area and the southern boundary, together with the northern boundary [21], of a trackway running west-south-west to east-north-east which seems to be respected by the termination of linears [19] and [20] forming an entrance into the platformed area. To the south, the reason for the interpretation of [25] and [27] as possible archaeological features is due to the difference in the comparative lack of strength of the magnetic signal compared to [26] suggesting they are geological anomalies. Conversely, the straightness and clarity of feature [26] in comparison to [19] raises questions about whether [26] is indeed a continuation of [19] and may be a modern field drainage channel. Another possibility is that linear feature [19] may be related to linear anomaly [25] due to its continuation in the same curvilinear arc and direction. The lack of clarity in the relationship between these features is compounded by the blurred anomaly shown in figure 38, running east-west across the centre of Field 1. Between features [19] and [20] lies a large, strong dipolar anomaly [A] which may be related to the 'trackway' feature of linear features [19] and [20] or to the circular feature [16] as monopolar features [S] and [T] may also be. Monopolar feature [U] is a very large feature which seems to be associated with linear [19], this feature is partly obscured by a partial grid for which data were incorrectly collected during the survey (see section 3.6.4) but may also obscure a re-continuation of linear [19] into the adjacent field to the north of the survey area.

### **Area B (figure 34)**

More evidence of field systems appears in the area east of linear [20] with several trapezoidal areas bounded by linear anomalies consistent with ditches which may have served as enclosures for farmland. Feature [21] appears to form the southern boundary of a field system that extends into the field to the north of the survey area and is not associated with the network of field boundaries to the south. There is however a possible trackway formed by its association with linear feature [23] leading into the platformed area. Field boundaries [18], [23], [28] and [35] are interrupted by magnetic anomalies [F], [G.] and [H] producing dipolar readings which may represent deliberate deposits in the field ditches

(Willis 1999, 97) similarly, monopolar reading [V] in the short feature [38] is apparent. Linear boundaries [35] and [36] terminate and may respect the large, interrupted circular feature [40] which contains several monopolar points that form a sub-circular pattern and scattered dipolar points.

### **Area C (figure 35)**

Area C is magnetically quieter than Area A and Area B which may suggest the discrete monopolar and dipolar points encountered in this area are significant, as does their position in relation to feature [40]. Although ferrous agricultural debris cannot be discounted in producing the smaller dipolar anomalies (see section 5.4) the circular pattern is suggestive of postholes. The significance of the dipolar anomaly in the centre of [40] would need further investigation. An indication of the level of agricultural activity is reflected in the regular horizontal responses indicative of ploughing and highlighted in figure 38. The large monopolar anomaly [R] is located directly to the north-east of feature [40] and may also be a pit associated with settlement activity, adding to the evidence of settlement in [40]. There are three other circular anomalies in this area of the Field 1, [33], [34] and [39] of which, [34] is irregular in shape and therefore difficult to distinguish as an archaeological feature. Features [33] and [39] are of a more regular, circular shape and seem to form a concentric pattern traversed by linear feature [42]. There are again many dipolar and monopolar points located inside the boundary of 33 which may be significant. Two linear features that protrude from inside feature [40], are [42] and [38]. [38] is obscured by the ploughed area and [42] could indicate a track leading from the quarried area or continuing down to the Sarre Penn in a north west-south east direction. If [40] were a settlement enclosure, its width of 50m could accommodate animals as well as humans. Feature [38] contains monopolar anomaly [V] which is another example of a possible pit dug into a ditch.

### **Area D (figure. 36)**

In area D there are a number of features, including a faint linear anomaly [41]. This feature traverses a large monopolar anomaly [K]. Circular feature [43] in this area is interrupted at its eastern side and has a linear feature running through it which may be two entrances or two features from different phases. The possibility of a kiln in this area may be consistent with the large quarried area to the east which may have been exploited for clay. This may explain the strong dipolar anomaly detected in the north-west section inside the circular boundary. Discrete linear feature [45] runs close by but does not connect with any other archaeological features.

### **Area E (fig. 37)**

The south of Area E contains several dipolar anomalies appear not to have any relation to other features or be associated with each other. During the survey there were a disproportionately high number of ferrous metal objects encountered by the surveying team on the surface in this area which may account for these readings and for an example of the material in figure 94. The faint nature of anomalies [17], [46] and [47] indicate that the features are geological rather than archaeological when they are compared to features [26] and [29] which produced the highest response of the features in Field 1 (see figure 43 trace and colour images for contrast) and whose clarity would suggest that this conditions in this part of the field are conducive to good preservation of archaeological features. Some attention can be paid to a collection of dipolar anomalies [C] which are up to 7m in diameter and are just outside the boundary of the platformed area.

### **Other features of note**

A large, blurred anomaly in the centre of the field, mentioned above, is possibly the result of alluvial action affecting the depth of the Head deposit, providing a contrast to the soil configuration in the rest of the field due to its location at the break of the slope as shown in the topographical model in figure 41. This area has obscured the relationship between some features as may be the case with the ploughed area in the east of Field 1 which resulted in similar responses to the faint results of the survey at Ewelme Manor, Oxfordshire (Milesen, 2011, fig. 9.2E) and stronger responses at Charlton Road, Keynsham (Harris, 2017, Fig. 3). The south-east corner of Field 1 presented a high, monopolar anomaly consistent with large area of contrasting deposits also shown on figure 38 which due to its size, may be a clay pit or quarry.

### **4.1.3. Field 2 (figures 44-57)**

#### **4.1.3.1. List of anomalies**

Anomaly number	Description of anomaly	Report area
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48	SW-NE running linear feature, 25m long, running through monopolar anomaly Y and north-west of dipolar anomaly O	F
49	NW-SE running linear feature 27m long, running from linear feature 50	F
50	W-E running linear feature, 28m long, parallel with linear feature 51	F, G
51	W-E running linear feature, 18m long, terminating at buried feature	G
52	NW-SE running linear feature, 10m long, parallel with angled linear feature 53	G
53	NW-SE running angled linear feature, 10m long, parallel with linear feature 52	G
54	Curvilinear feature forming semi-oval shape over 7m long protruding from west boundary of field	G
55	W-E angled linear anomaly, 18m long	G
56	Rectangular feature 16m long	G
57	Semi-circular feature, 11m diameter	G
58	NW-SE linear feature, over 20m long, parallel with linear feature 59	G
59	NW-SE stepped, linear feature almost 30 long, parallel with linear feature 58	G
60	SW-NE running linear feature, 25m long	G
61	Rectilinear discrete feature 10m long	F
62	NW-SE running linear feature, south of monopolar anomaly AA	G
63	NW-SE running linear feature, 30m long	G
64	NW-SE running linear feature, 22m long	G
65	N-S running linear feature bounded by line 65 to the west and the path to the east	F, G
M	Discrete, oval-shaped dipolar anomaly, 12m in length	G

N	Discrete, circular-shaped, dipolar anomaly, 8m in diameter covering area of electrical pole	F
O	Discrete, circular-shaped, dipolar anomaly, 6m in diameter	F
W	Discrete, oval-shaped monopolar anomaly, 8m long,	G
X	Discrete, circular-shaped, monopolar anomaly, 9m in diameter	F
Y	Discrete, sub-rectangular monopolar anomaly, 17m long	G
Z	Discrete, linear monopolar anomaly, 40m long and 7m wide	G
AA	Discrete, irregular-shaped, monopolar anomaly, 14m long, north of linear feature 51	G
AB	Discrete, irregular-shaped, monopolar anomaly, 11m long, between linear features 50 and 51	G

#### 4.1.3.2. Initial interpretations by survey area

##### Area F (Figure 51)

Features in area F do not appear to have any relationship with features in Field 1 although linear features [48], [49] and [50] may extend into the field west of the survey area which was not included in this project. There is a significant discrete dipolar anomaly [O] south of a similar sized monopolar anomaly [X] which may relate to curvilinear feature [48] it is possible that [48] is interrupted in its continuation to [49] or even [50]. Evidence of settlement activity could also be supported by feature [61] which is a discrete but distinct feature of regular shape and is similar in definition to the image of the possible built feature [56]. Dipolar anomaly [N] is likely to be the result of the telegraph pole erected there containing ferrous material in the foundations or discarded around it although archaeological potential cannot be discounted as this may be co-incidental.

##### Area G (Figure 52)

Area G is a scheduled monument area containing a wealth of earthworks possibly relating to a dispersed medieval settlement (discussed further in section 5.3) and the magnetometer results show some features, [Y], [Z], and [56], which may be consistent with this. Due to time constraints and thick brambles surrounding a tree, two grids to the south east of this

area have not been surveyed and may present more information about potential relationships of linear features [58], [59] and [60] with [62] and [65]. The position of the buried anomalies also affects the interpretation of the relationship of [58], [59] and [60] with [52] and [53]. The results show monopolar anomalies protruding into the west of the survey area [W], [AA] and [AB] which do not seem to form part of a ditch system or correspond with the earthworks. These features may represent industrial activity carried out in the medieval phase of the site (section 5.3). Monopolar anomaly [Y] covers a large area associated with feature [56] which forms three sides of a rectangular feature which appears be a building. Another extremely large area of monopolar reading [Z] runs immediately west of a large dipolar feature [W], again indicating industrial activity in the form of a pond or small quarry and does not appear to continue as part of a ditch or trackway in the greyscale image. The traceplot image in figure 57 however, seems to show the same readings continuing in the direction of feature [6] in Field 1.

#### **Other features of note**

Local residents informed the survey team of a large amount of refuse dumped in the area to the north of the buried anomalies, shown in the survey results as a collection of large dipolar anomalies and identified as a rubbish dump in figure 38. For this reason, it has been discounted as an area of potential archaeology

### **4.2. Resistivity survey (figures 58-68).**

- 4.2.1.** A list of the features identified in Field 2 and discussed below has been compiled for ease of reference. Building features are highlighted as red, ditches in green, a pathway in yellow and buried anomalies in blue. The same colour key is used in the graphical representations of all the interpretation plans of the resistivity results.

#### **4.2.2. List of anomalies**

Anomaly Label	Description of anomaly
B1	Blurred high resistance rectilinear feature 20m x 8m, possibly continuing from west of the survey area, area of low resistance in eastern enclosed area
B2	Related, medium resistance, rectilinear features, 22m x 13m possible building, sub-circular feature to west possible apse

B3	Collection of high resistance rectilinear features consistent with walls forming a cruciform shape 44m long (east-west) x 31m wide at cruciform point and 17m wide at the east section. Walls form multiple rectilinear areas or corridors with several low resistance readings within the boundaries and three notable sub-circular areas of high resistance
B4	Related high resistance linear, and rectilinear features, 17m x 7m, consistent with walls forming right angled and parallel features. Possibly related to medium resolution 45m feature running SW-NE through [B3]
B5	Parallel high resistance features running SW-NE, 10m x 3m consistent with walls
B6	Rectilinear feature, 11m x 7m, interrupted at NW corner, respecting [D4] and enclosing low resistivity area.
B7	Rectilinear feature, 10m x 7m, interrupted at NW corner, respecting [D4]]
D1	SW-NE running high resistance linear feature, 4m wide with area of low resistance running along the south.
D2	SW-NE running, linear feature, 5m wide with mottled high resistance readings, running in the direction of the church
D3	NW-E running curvilinear feature between 7m and 8m wide with mottled high resistance readings
D4	NW-E running, curvilinear feature 11m wide at north-west end widening to 20m wide at east end, showing consistent high resistance readings along its north and south edges which become denser at the east end. Containing [B5] in the east end and running directly south of [B4], [B6] and [B7].
D5	Possible west side of SE-NW running ditch
P1	E-W running high resistivity linear response, approximately 20m x 7m, terminating just before west end of [B3], even higher response linear feature running along the northern edge and continuing to meet [B3].
A1	NW-SE running linear, low resistance anomaly min. 31m long x less than 1m wide
A2	SW-NE running, low resistance linear anomaly 38m long x less than 1m wide

#### 4.2.3. Initial interpretations

Most prominent is the large rectilinear feature [B3] running east-west through grids C, D and E. The feature is consistent with a large building or series of large buildings constructed on the site over several phases. The features seem to respect each other and therefore may represent one single phase of construction or a series of extensions applied to a principle structure. The building seems to be served by a pathway [P1] leading from the west of the survey area in grid C which represents a regular response in the majority of the area possibly indicating metalling or surfacing with a consistent material. Higher resistance responses running along the north edge of [P1] to the building itself may represent a wall. There are other high resistivity rectilinear readings consistent with buildings [B4], [B6] and [B7] respecting ditch [D4] which due to its width appears to be a road or holloway with banks either side. [B4] in particular is a discrete feature suggestive of the start or end of a corridor and the corner of a building, although there are no features immediately connecting with it, a faint diagonal feature running through [B3] may form a right angle somewhere in the west of grid 8. [B1] represents a strong, high, rectilinear resistivity reading consistent with more walls and [B2] is a fainter reading that may represent built features deeper than those of [B1], [B3], [B4], [B5], [B6] and [B7], indicating an earlier phase. The sub-circular feature in [B2] may represent an apsidal feature such as a garden or courtyard as it does not seem to be surrounded by walls which would suggest a room. Two further ditches [D2] and [D3] that may represent trackways appear to terminate at this feature and suggest a structure of some importance. Several areas of high resistance which appear within the structure of building [B3] and highlighted as anomalies on the interpretation plans may represent accumulation of building material associated with a fireplace or hearth or other built feature within the structure. The ditches to the north and south of the survey area [D1] and [D4] most likely represent holloways or trackways passing the original structures due to their width and respect of the built features between the two. [D1] represents a very high resistance feature which, due to its width, is unlikely to be a wall and extends in the direction of the churchyard. The very low resistance signal extending the length of the south edge of [D1] and possibly along the north out of the survey area is difficult to interpret and may contain material associated with [B2] that has been dug out of it. Many low-resistance responses are located within the walls of the buildings and show as very light or white areas in the survey results in the east end of [B1], covering the entire north-south and east 'wings' of [B3] and also the east edge of the inside of [B6]. This may be due to the accumulation of water on non-porous surfaces such as metalled, tiled or concrete floors which supports the hypothesis

that these are buildings of some prominence.

## **5. Discussion of results**

**5.1.** In accordance with the research aims of this report, the results of both the magnetometry and resistivity surveys are interpreted in comparison with each other as well as current understanding of the site and its immediate surroundings derived from previous fieldwork, historical research, cropmarks and maps. The above description of the survey results has largely ignored previous evidence due to the risk of confirmation bias affecting the interpretation. Much of the previous results rely on the account of the Blean Research and Archaeology Group's project compiled by Simon St. Clair-Terry (St. Clair-Terry, 1986). However, the author has been unable to access the empirical evidence supporting the interpretation by St. Clair-Terry which therefore should be approached with an element of caution. The importance St. Clair-Terry's fieldwalking survey of Field 2 has not only informed the scheduling by Historic England but also influenced the research aims of this report and therefore cannot be underestimated. It is however, beyond the scope of this report to evaluate the evidence in its entirety and will focus therefore on the contribution it makes to the understanding of the geophysical survey results and how those results confirm or refute the interpretation from the fieldwalking survey. In this section the results of the geophysical survey in comparison with all other significant existing evidence will be explored in detail.

### **5.1.1. Prehistoric**

Fieldwalking has produced finds in the area consistent with occupational activity from as far back as the Mesolithic period at the banks of the Sarre Penn river running to the south of the site and west of Tyler Hill by Canterbury Archaeological Trust (Cross 1992, 42-44) and to the south of the survey area by members of the Blean Research Group (Holmes and Wheaten 2002, 49). Fieldwalking undertaken in the area north of Field 1 by post-graduate students at the University of Kent in 2010 recovered pot-boilers and worked flint in quantities suggestive of prehistoric settlement in the immediate area (Knapp 2010). The field system is more complex and regular than perhaps would be expected at a prehistoric site (Gaffney and Gater 2003, 123) however, everyday items such as the pot boilers would not usually be portable and were probably deposited *in situ*. Field boundaries [19], [20] and [21], as previously discussed, may have been re-cuts of an older boundary dating back to the

prehistoric period. St. Clair-Terry presents no further evidence of occupation from the prehistoric period apart from highlighting the presence of tumuli in Clowes Wood, north of the survey area and marked on figure 69. Although the nature of prehistoric archaeology ‘severely limits geophysical techniques’ (Gaffney and Gater, 2003, 120), the evidence from the fieldwalking and proximity of monuments can re-evaluate the interpretation of the magnetometry results in Field 1. It could be hypothesised that the possible archaeological anomaly [17] is a palaeochannel, the remains of an earlier water course which perhaps has been diverted along the east of Field 1 over the centuries. This would have attracted wildlife as well as being a source of water for livestock or humans and is a further indication of the attractiveness of this site for human settlement. Interpretation of the circular anomalies in the Field 1, particularly [16], [39] and [43], could also be re-interpreted as potential prehistoric burial monuments. The presence of prehistoric archaeology is unlikely to influence interpretation of the results in Field 2 due to the interference from the buried anomalies affecting the greyscale results and the resistivity method predominately detecting structural remains post-dating the prehistoric period,

#### **5.1.2. Roman and Medieval**

The presence of material in and around Field 2 is reported in detail in the report by St. Clair-Terry and dates from 2<sup>nd</sup>-4<sup>th</sup> century Roman to Medieval. Roman ceramic building material in the form of bricks can be clearly seen from the fabric of the 12<sup>th</sup> century church of St Cosmus and St Damian in figure 70. Although it is possible building material may have been carried some distance, Roman pottery in Field 2, which is likely to have been deposited in situ, was recovered by St. Clair-Terry (1986) and from the field north of areas C and D by Knapp (2010). St. Clair-Terry’s illustrated interpretation of the area (reproduced in figure 71) uses the OS Mastermap topography data to mark the earthworks and the results of the fieldwalking to interpret where the archaeological features were. As can be seen, the building [B3] found on the resistivity survey data does not correspond to his interpretation in any way and is, in fact, not recognised at all. The overwhelming evidence from the survey results of a built feature in this area calls into question the efficacy of the fieldwalking exercise in determining the site of features due to artefact assemblage data although, its value in identifying the site itself is what has led to this project. When transposing the results of the resistivity survey over the interpretation presented by St. Clair-Terry in figure 72 although without ground truthing, all hypotheses remain uncertain for any method. The resistivity evidence also supports the rectilinear feature [56], identified in the magnetometry survey, as being the remains of a building. However, conversely, the

fieldwalking data may contribute more in interpreting [B2] as the site of the medieval manor house and [B3] as the remains of the Roman villa purported to be at the site by the Roman material collected during St. Clair-Terry's fieldwalking project. This may also be supported by the location of the medieval building on the topographically flatter land. Although building [B6] does not appear on St. Clair-Terry's interpretation, [B7] is interpreted to be a forge, this is consistent with evidence of the building remains on the resistivity survey and the anomalies [M] and [Z] identified in the magnetometry survey. Dipolar anomaly [M] may represent refuse from metalworking such as bowls of slag and monopolar anomaly [Z] may be a pond dug to provide the furnace with water and their location adjacent to [B7] would support that hypothesis. [D1] disappears from the interpretation by St. Clair-Terry and the OS data at the north-east corner of the field however, ground level observation of the churchyard north of the church and visible in figure 73, shows a continuation of the ditch and bank which forms a pathway across and into the north-west corner of Field 1. This establishes a possible link between the two fields and following the direction of the features, they could possibly continue to the pathway formed by features [21] and [23] in Area A. The area field walked by Knapp in 2010 is directly to the north of feature [21] and contained 50 sherds of Roman pottery. Another link could be established from a Roman imbrex seen in figure 95 and recovered from the south of area A by a volunteer during the magnetometry survey.

Finally, St. Clair-Terry notes the presence of burnt material from the medieval phase of the site (St. Clair-Terry, 1986, 13) suggesting that the manor house was burnt down and never reconstructed, these could be burnt remnants from the possible hearth areas identified as anomalies in the resistivity survey interpretation. However, the magnetometry data indicate a monopolar anomaly [Y] over the remaining area of the building east of the buried anomalies and north of the rectilinear magnetometry response [56]; as the burning of the building may not have reached the Curie point at which a dipolar response would be produced, this may be consistent with the burnt destruction event, further supporting hypothesis of the manor house site.

### **5.1.3. Aerial images**

Images of Field 1 from satellite and aerial photography can be used to identify sites of archaeological potential through cropmarks which are visible anomalies in the growth of crops, often caused by buried archaeological remains (Wilson 1982, 67), for example positive cropmarks over ditches and negative cropmarks over wall foundations. Images from different years can produce different results due to the time of year or day that they are taken, as can be seen in figures 75 and 76 and some are virtually imperceptible as in the



2017 image 77, proving that the latest technology does not necessarily achieve the best results. Although the quality of the images may play a part, type of crop planted and the matrix of soil, in this case heavy London Clay, may also have a detrimental effect on the definition of the cropmarks due to the way moisture is stored as opposed to light, gravel soils which drain freely and produce faster and more pronounced anomalous results in crop growth (Wilson 1982, 69-70 for more information on cropmarks on shallow soil on chalk, as at the survey area). As demonstrated in figure 78, many of the cropmarks in the 1990 image are similar to those of the 2016 image shown in figure 79 and some appear only in the former. The images show consistency over the quarter century indicating that they are not marks left by agricultural machinery. As can be seen by the transposed cropmarks on the magnetometry survey results in figure 80, cropmarks appear in the survey results that do not appear in the aerial images proving that the survey in this area is much more effective at locating archaeological features. However, the relationship between features [28] and [29], which is obscured by the blurred anomaly running across the centre of the magnetometry results, are clearly seen in the figure 78 1990 image as two parts of the same continuous feature. It is therefore valuable to examine the images from different periods especially when the survey results are obscured by anomalous survey conditions. Another feature which appears as a discrete anomaly in the survey results is the quarried area shown in figure 38. Results from the 2016 aerial images clearly show human intervention in the area, although it is impossible to know of what type and may indicate that the results on the survey are not contemporary with the other archaeological features interpreted above. Cropmarks indicating the field systems and circular features can be rectified using geophysics which can be used to refine the results. However these are unreliable indicators of date and, although some responses such as the 'typical Cornish double response' (Gaffney and Gater, 2003, 124) are indicative of older field boundaries, they are often recut and follow the same line for centuries. No evidence of distinctive-period field systems exists in Field 1 or Field 2 from either the satellite and aerial field images or the survey results. Finally, the aerial images can also assist in discounting certain hypotheses. Feature [26] in area A is hypothesised as a potential field drainage channel however the 2007 aerial image on figure 81 clearly shows a herringbone field drainage system has been employed in the field directly south (see figure 81, after Namitha 2015, for a diagram of field drainage systems). The main channels of the herringbone system do not correspond to any of the north-south archaeological features in the survey area. It seems unlikely that a parallel drainage system would be employed in the field directly adjacent to one in which a herringbone system had been used.

#### 5.1.4. Topographical

Topographical information has been gathered on the survey area from Ordnance Survey Mastermap topography layer, contour models derived from LiDAR information or simply walking across the target area. In each case there are contributions to the interpretation of the geophysical survey results. As discussed above, the raised platform area in Field 1 is clearly confirmed by the LiDAR derived contour model in figure 41 showing a trapezoidal shape of raised topography in the north-west corner. The line of blurred anomaly in Field 1 is also clearly seen to be at the break of the slope, supporting the hypothesis in section 4.1.1. The topography data are perhaps even more important in assisting with the interpretation of Field 2 which has a complex network of earthworks, particularly in the scheduled monument area. The results of the magnetometry survey correspond to the OS Mastermap layer in only three areas and are clearly visible when comparing the OS topography data with the magnetometry results in figure 83, only two of these features contribute anything meaningful to the discussion. On the OS data, linear feature [65] appears to continue north along the whole length of the Salt Road and is posited as a Roman feature by St. Clair-Terry (1986) and Holmes and Wheaton (2008) therefore predating the church. The earthworks do not account for any features that may have truncated the earlier earthworks yet have still left a similar footprint on the topography such as features [M], [Z] and [B7]. The other anomaly to which the data contributes is [Z] which may represent a pond or pit. The earthworks to the west of feature [Z] run the exact length of the anomaly and, rather than representing a boundary, may be a bank of earth created as a result of the pit being dug and may have no ulterior use as a boundary. This would be in contradiction of St. Clair-Terry's interpretation of a banked trackway leading into the churchyard (fig. 71). The OS earthwork data is considerably more valuable in interpreting the resistivity results in Field 2 as can be seen in figure 84. Many of the features identified by the survey correspond to the OS Mastermap layer exactly with [B1] and [P1] in particular producing a high resistance response and matching the topographical layer. [B1] represents an interesting case where anecdotal information discounted the area as a rubbish dump and led to a presumption of absence of archaeology in the magnetometry report (see section 4.1.2, Other features of note). The results from the resistivity survey transposed by the topographical layer suggest that the area is particularly suitable for further investigation and may indeed contain significant archaeology. The above contribute to interpretation of the site when viewing it from the ground level as figures 85-88 show in photographs of the site with reference to the survey results, particularly with the continuation of [D1] in figure 88 as discussed above and the slight flattening of the earthworks at the site of [B7] visible in figure 87.

#### **5.1.5. Other evidence**

Material was noted but not collected systematically during the course of the survey in Field 1, it can however contribute to understanding the results of the geophysical survey. The platformed area in Field 1, as has already been mentioned, contained many fragments of Kent peg tiles that suggest building activity in that area, figure 93 is an example of one tile fragment recovered and supports its interpretation as a toft or building platform. This material is consistent with that found in the scheduled monument area by St. Clair-Terry. As also previously mentioned, several ferrous fragments of modern farm machinery such as the fragment in figure 94 were noticed in the south part of Field 1 and may have contributed to the smaller dipolar anomalous responses in this area. Enquiries of the landowners to establish the nature of the buried anomalies in Field 2 were unsuccessful. However, the responses in both the magnetometry and resistivity surveys could establish a strong interpretation consistent with buried metal cables or wires. Evidence gained from walking the site prior to the survey began helped establish that feature [K] in Field 1 was a hay bale that had been burned shortly before the survey began and produced a response that could easily have been interpreted as archaeological in figure 42. The author viewed the Portable Antiquities Scheme website for evidence of artefacts from the site recovered by a local metal detectorist. Although the detectorist reported finds from various locations on the site there was no official record that could be referenced for this report.

## **6. Conclusion**

### **6.1. Evaluation of method**

#### **6.1.1. Magnetometry**

Magnetometry was employed over both Field 1 and Field 2 and proved to be a relatively rapid and effective method for surveying the types of archaeological features suggested by other evidence. There were clear advantages to using the magnetometry method in Field 1 for identifying cut features such as ditches which revealed a network of field systems that provide a basis for further investigation. The method also detected anomalies that could be associated with the cut features that supported the hypothesis of a settlement and require further investigation. Dipolar features that suggest burning or firing at high temperatures were located close to and in possible settlement enclosures. Despite the technical problems with the buried anomalies in Field 2 the survey produced results that were useful in the

context of other evidence.

### **6.1.2. Resistivity**

The results of the resistivity were highly successful in identifying sub-soil remains of built features such as walls and floors. The configuration of the features in Field 2 contribute greatly to the understanding of the scheduled monument area and will form part of a report to be published with Historic England.

### **6.1.3. Comparison of methods**

The respective results were effective depending on certain conditions, the buried anomalies in Field 2 presenting a particular problem for the magnetometry results. Effective comparative analysis of the results of the surveys with that of the existing evidence increases the value of the constituent parts as has been proved in section 5. The overall assessment is that the survey has greatly enhanced understanding of the site notwithstanding that the evidence acquired through fieldwalking and analysis of cropmarks is imperative in the initial evaluation of potential areas of archaeological interest. A final comparison of the results of the surveys is shown in figures 91 and 92 where the interpretation plans of resistivity and magnetometry surveys are transposed onto the results of each other.

## **6.2. Further research**

### **6.2.1. Fieldwalking**

Fieldwalking surveys are recommended in the platformed area in Field 1 due to the evidence of continued settlement discussed above.

### **6.2.2. Resistivity**

Results from the resistivity survey in Field 2 indicate that the soil conditions are conducive to successful results and resistivity would represent a low-cost method of investigation for built features.

- Platformed area

There is evidence that the platformed area in Field 1 would be better understood by conducting a resistivity survey due to the combined evidence of a relatively large number of peg tiles, the higher elevation in comparison with the rest of Field 1 and the evidence from the magnetometry survey of a long period of occupation indicating the likelihood of building remains.

- Cluster of anomalous points

The cluster of anomalies at the end of linear feature [11] may represent a built feature and further investigation by resistivity is recommended.

### **6.2.3. Excavation**

Excavation would be subject to many factors including cost, timeframe and numbers of participants. Figures 96-99 show a graphical representation of where trenches could ideally be placed to capitalise on the information interpreted from the survey results and explore the following:

1. Possible postholes associated with building [16]
2. Relationship between circular feature [16] and linear feature [7]
3. Relationship between linear features [30], [31] and [15] and anomaly [E]
4. Relationship between linears [19], [20] and [A]
5. Relationships between [25], [26] and [27]
6. Relationship between semi-circular feature [2] and linear feature [8]
7. Nature of feature [V] and its relationship with [38]
8. Nature of feature [R]
9. Nature of cluster of anomalies and their relationship with [39]
10. Nature of [L] and the relationship between it and linear features [33] and [34]
11. Nature of [G] and its relationship with linear features [35] and [18]
12. Relationship between [40] and [42]
13. Nature of [J]
14. Nature of [B1]
15. Nature of [B2] and its relationship with and the nature of [D3]
16. Nature of [B3] and the east anomaly and the nature of [Y]
17. Nature of [B6], [Z] and [D4] and the relationship between them
18. Nature of [M] and [Z] and the relationship between them
19. Relationship between walls of [B3] and the south west anomaly and nature of south west- north east running buried anomaly

20. Establish validity of south west-north east running wall of [B4] and its relationship with [B3]
21. Nature of [B4] and its relationship with [D4]
22. Relationship between [D4] and [D5]
23. Nature of B7 and its relationship with [D4]
24. Wall terminus of B2 and the nature of [D2]
25. Nature of [D1]
26. Nature of [B5]
27. Nature of [U]
28. Nature of [P1]

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## Images

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- Figure 95: Fragment of Roman imbrex found in the south of Field 1

## **10. Images**



Fig. 1: Kent in national context





Fig. 2: Survey area in Kent context



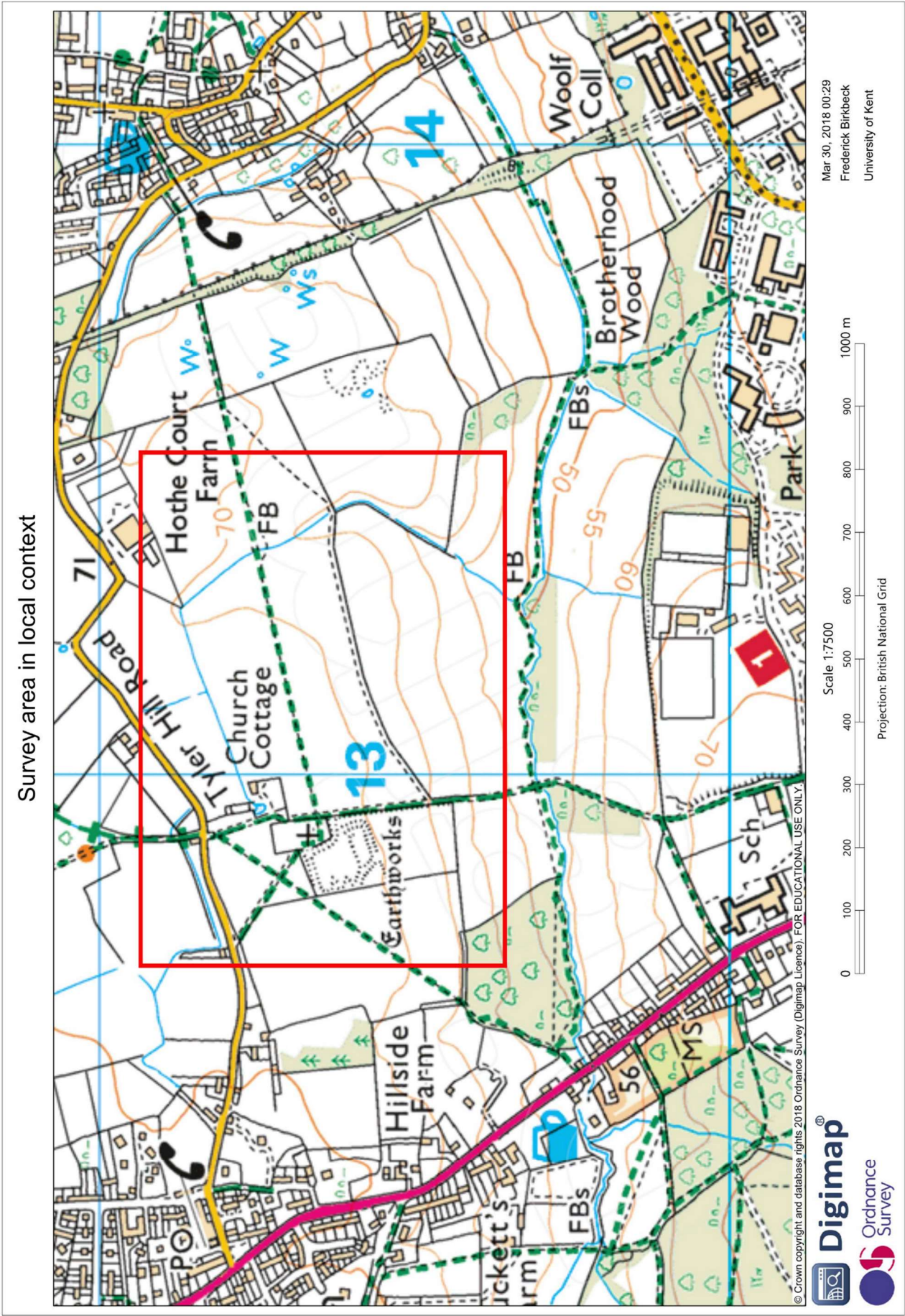
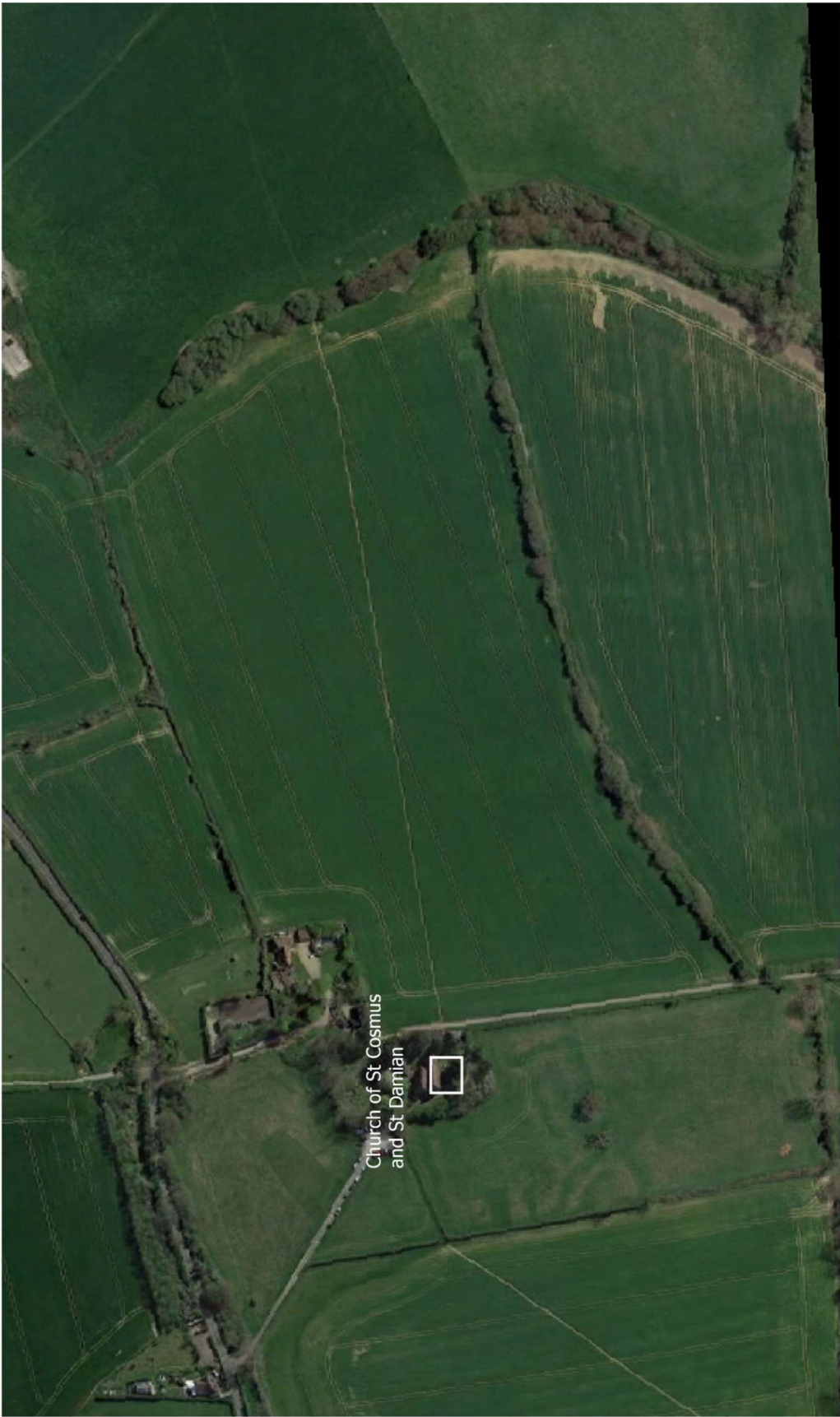


Fig. 3: Survey area in local context





**Survey area 2017 aerial view highlighting Church of St  
Cosmus and St Damian**

Source © 2018 Google



**Fig. 4: Survey area 2017 aerial view highlighting Church of St Cosmus and St Damian**



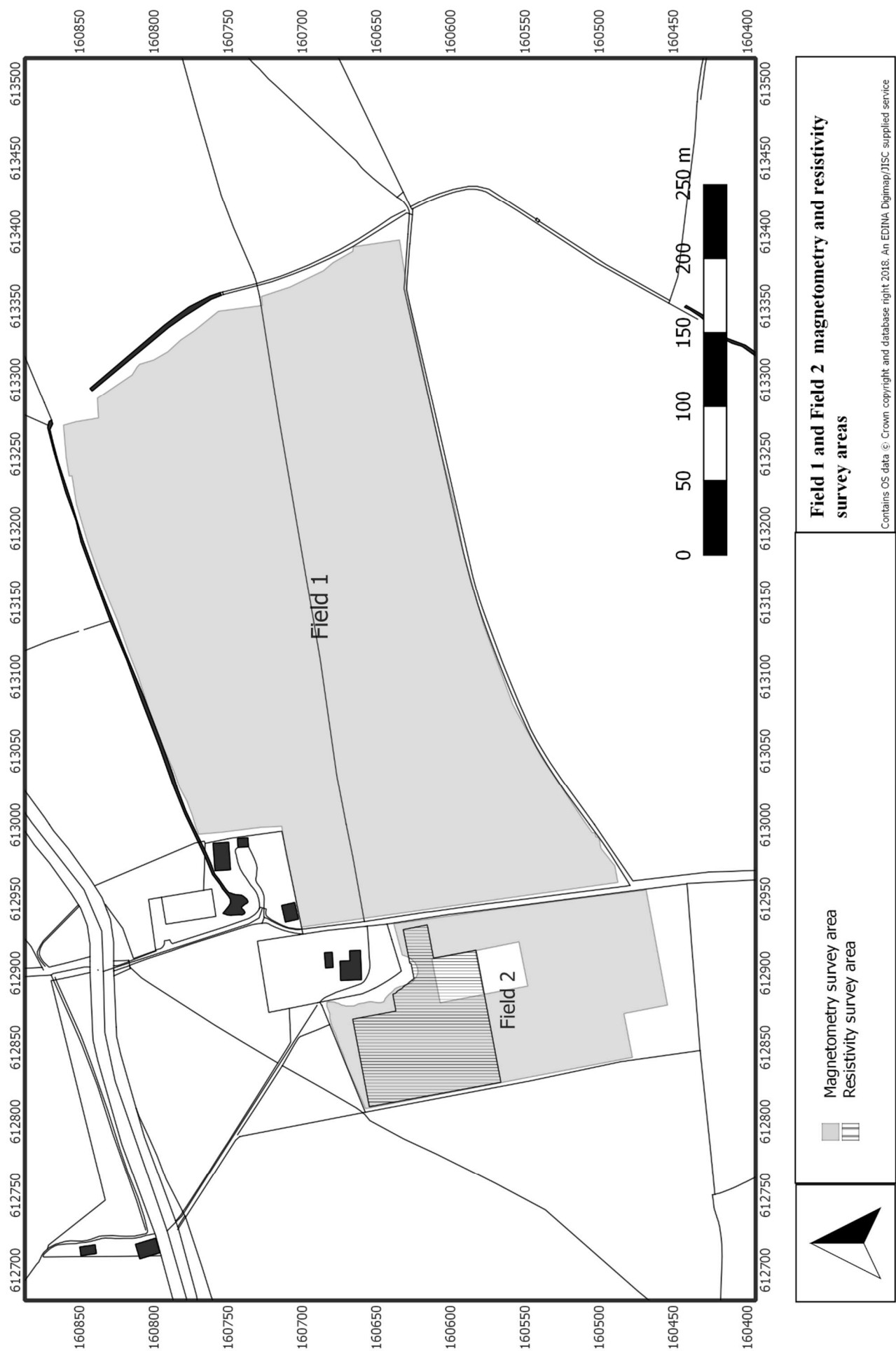
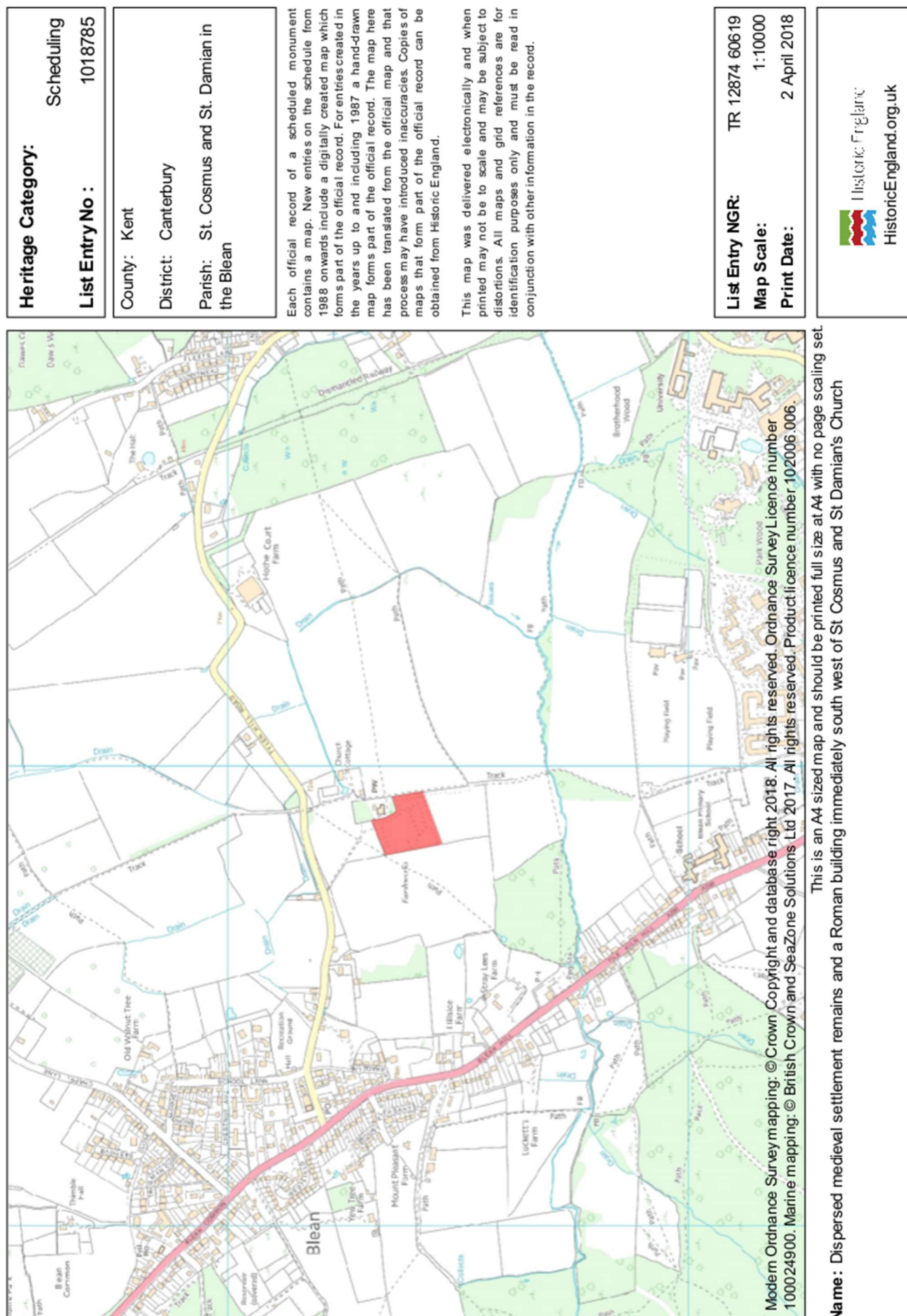


Fig. 5:



**Fig. 6: Field 2 scheduled monument area**

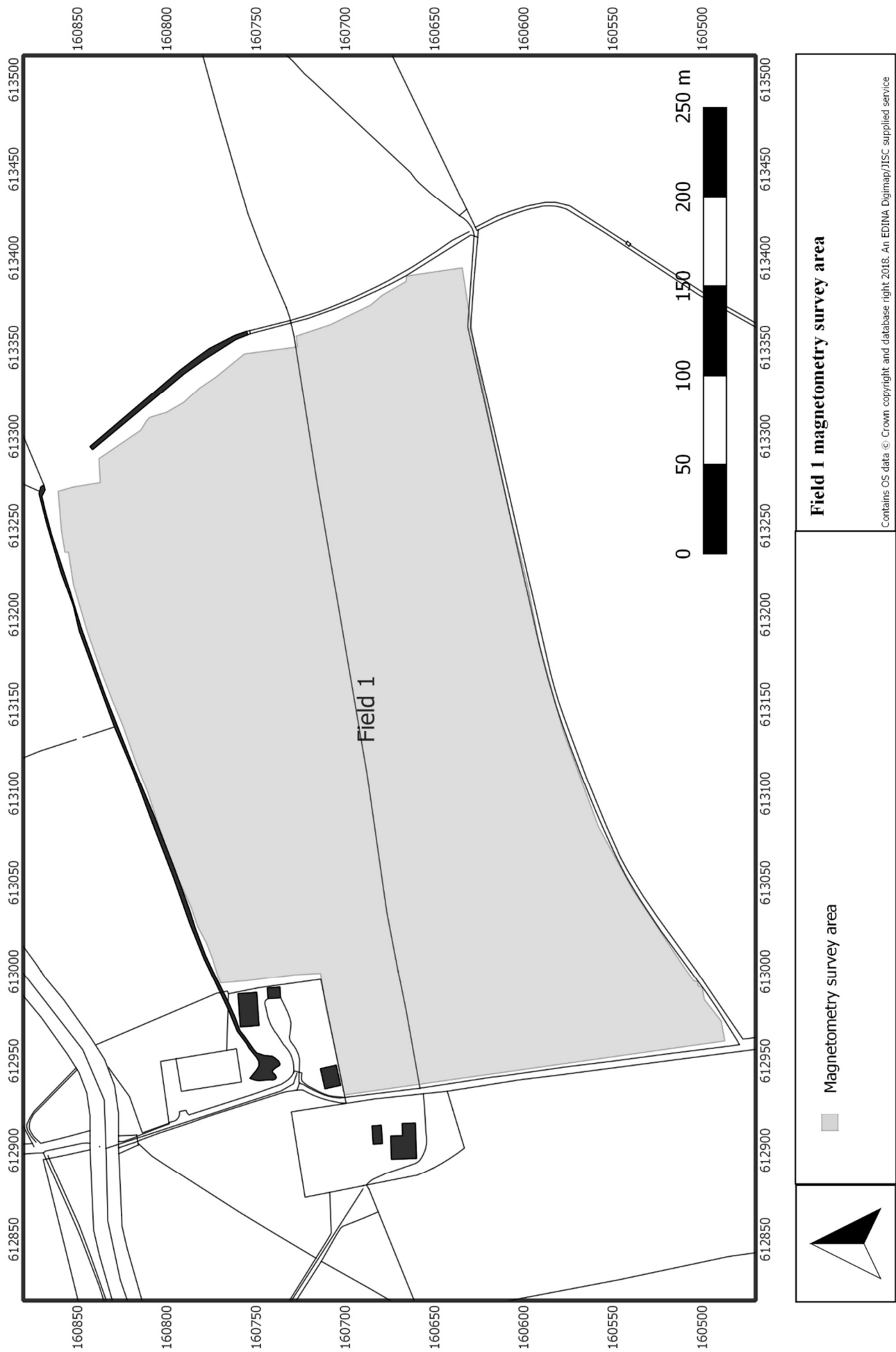


Fig. 7

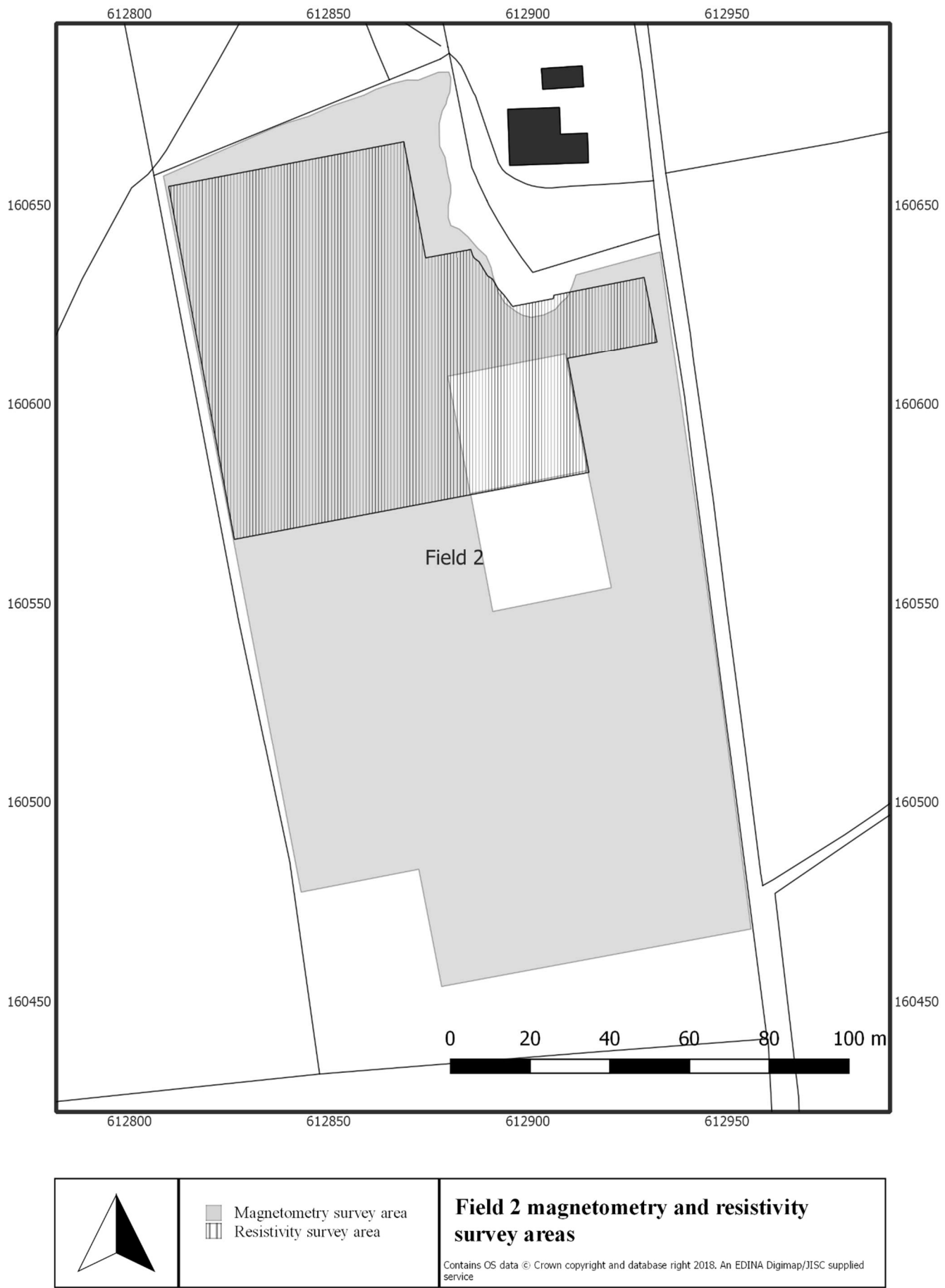


Fig. 8





**Fig. 9: Boundary of churchyard showing metal fence and brambles**



**Fig. 10: View to north of Field 2 to fence and car park**





**Fig. 11: Field 1 field conditions**



**Fig. 12: Field 2 field conditions**





**Fig. 13: Field 2 tree with obstructive brambles**



**Fig. 14: Field 2 overhead utilities and poles**

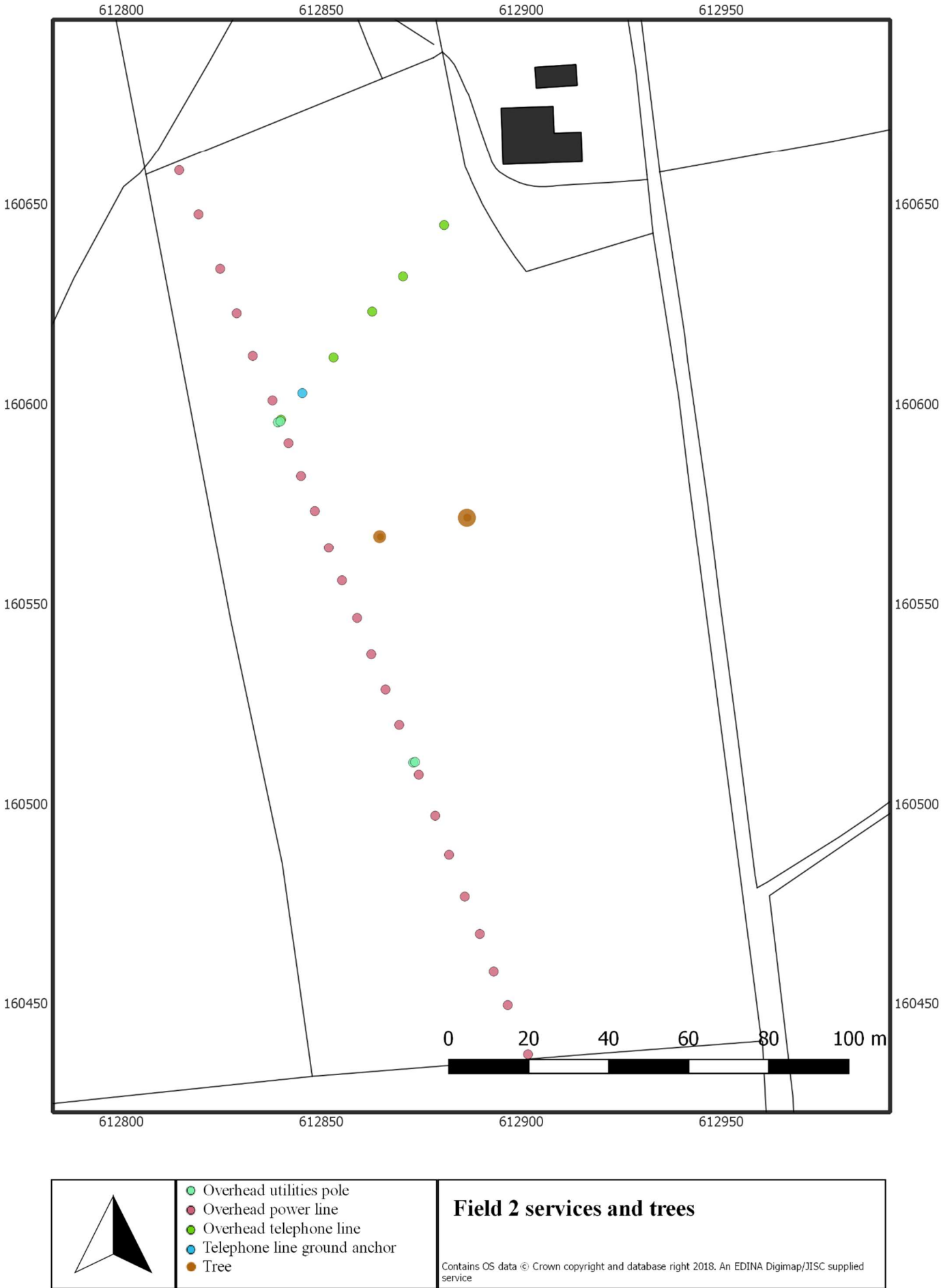


Fig. 15



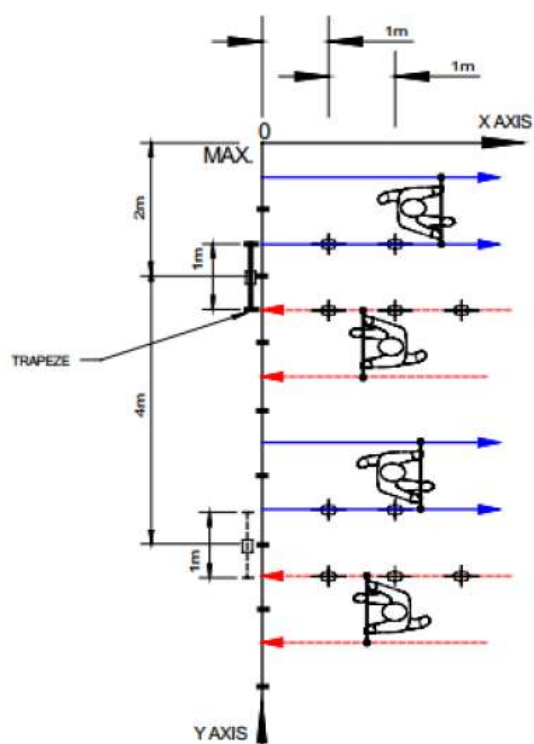


Fig. 16:





**Fig. 17: Bartington Grad601 fluxgate gradiometer used in the magnetometry surveys**



For a parallel pattern, the operator returns to the Y axis after completing each traverse and walks in the same direction (indicated in blue) each time

**Fig. 18: Dual sensor magnetometer operation in zig-zag pattern with 1m traverses with instructions for parallel traverses**





**Fig. 19: Cones marked the end of the traverses and were moved by volunteers**  
(source: Simona Cibulkova)



**Fig. 20: Agricultural machinery hampered attempts to re-survey a corrupted partial grid in Field 1**





**Fig. 21: Geoscan RM85 resistance meter used in the resistivity survey in Field 2**



Fig. 22



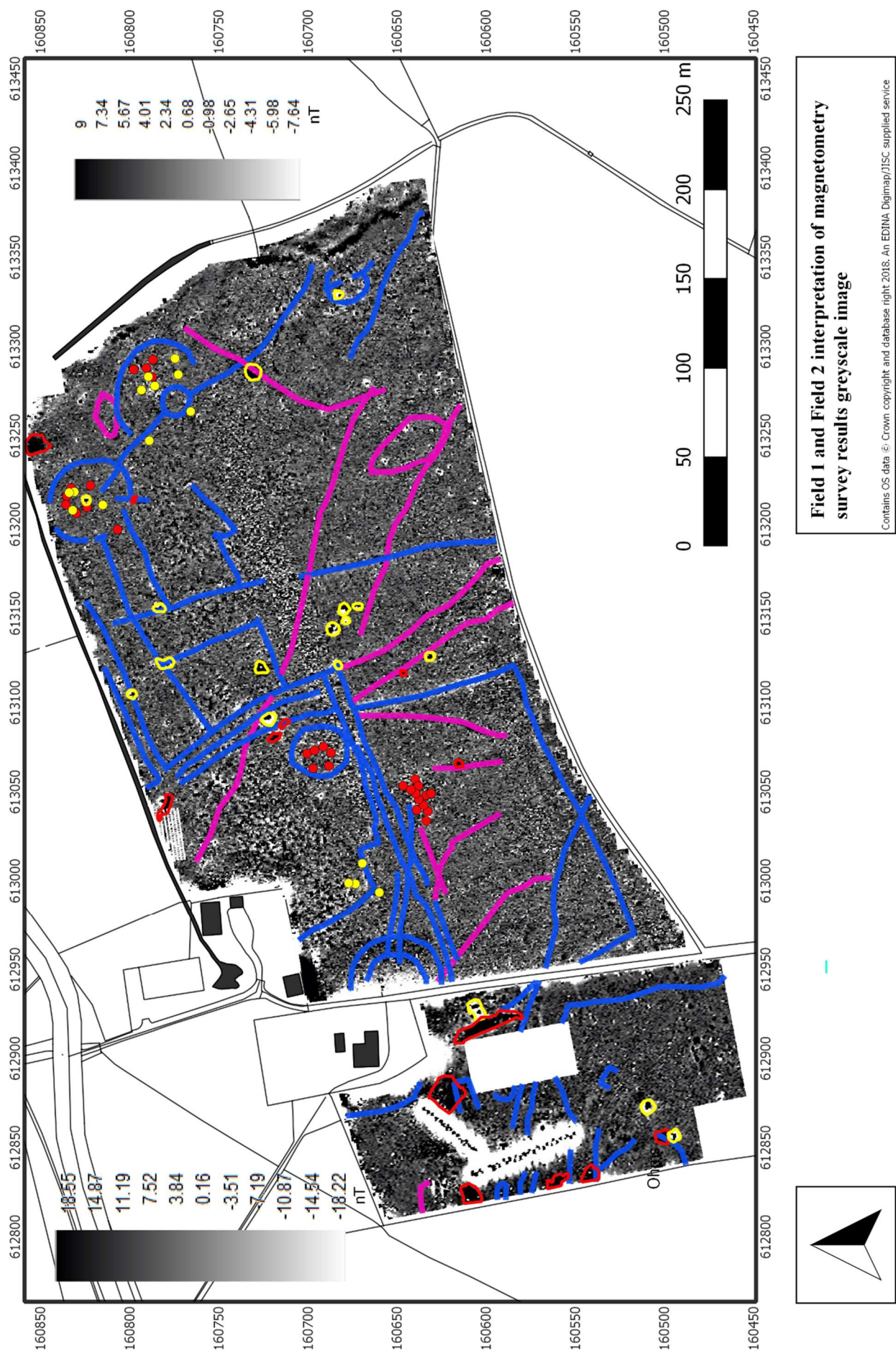
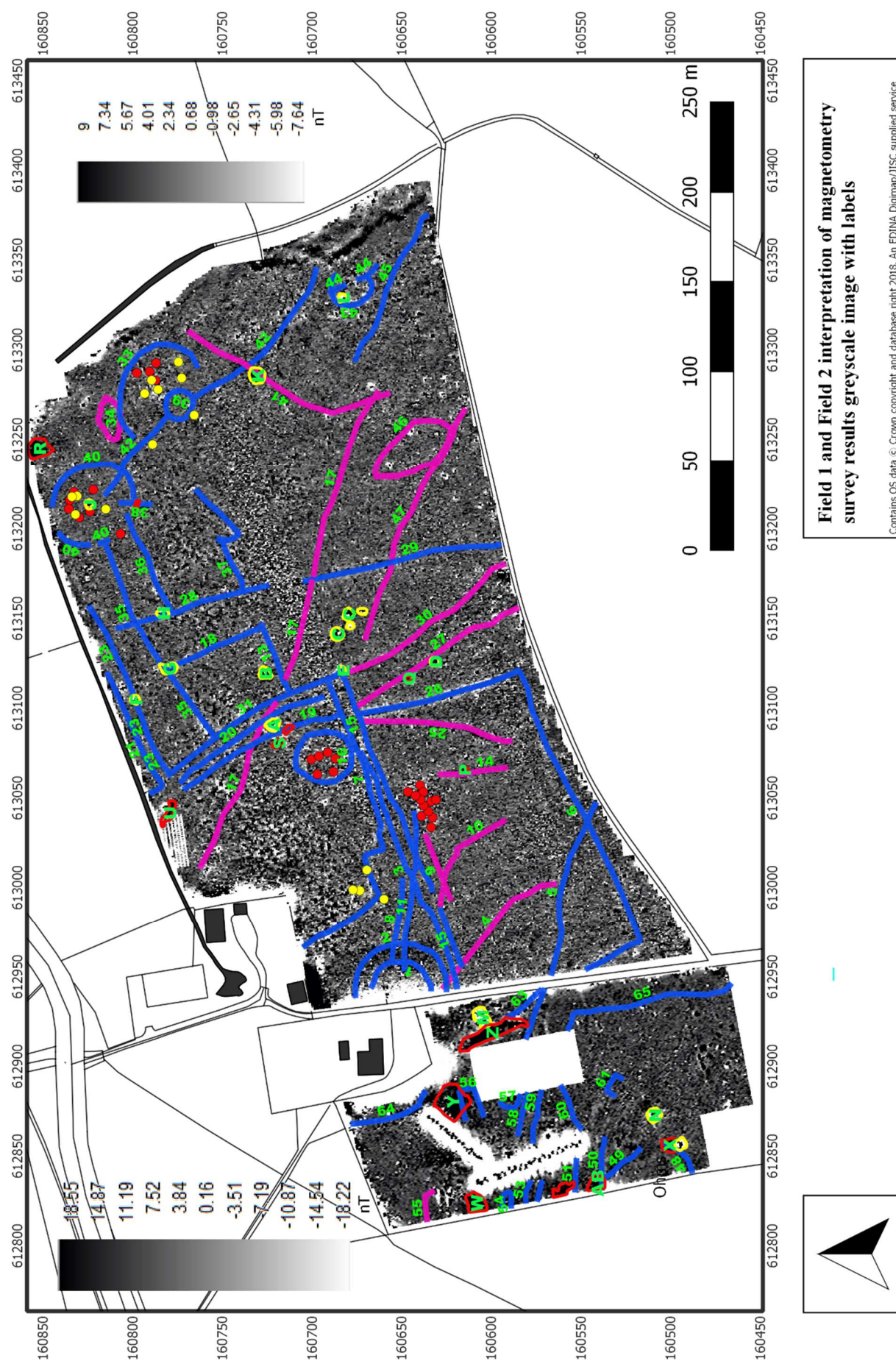


Fig. 23





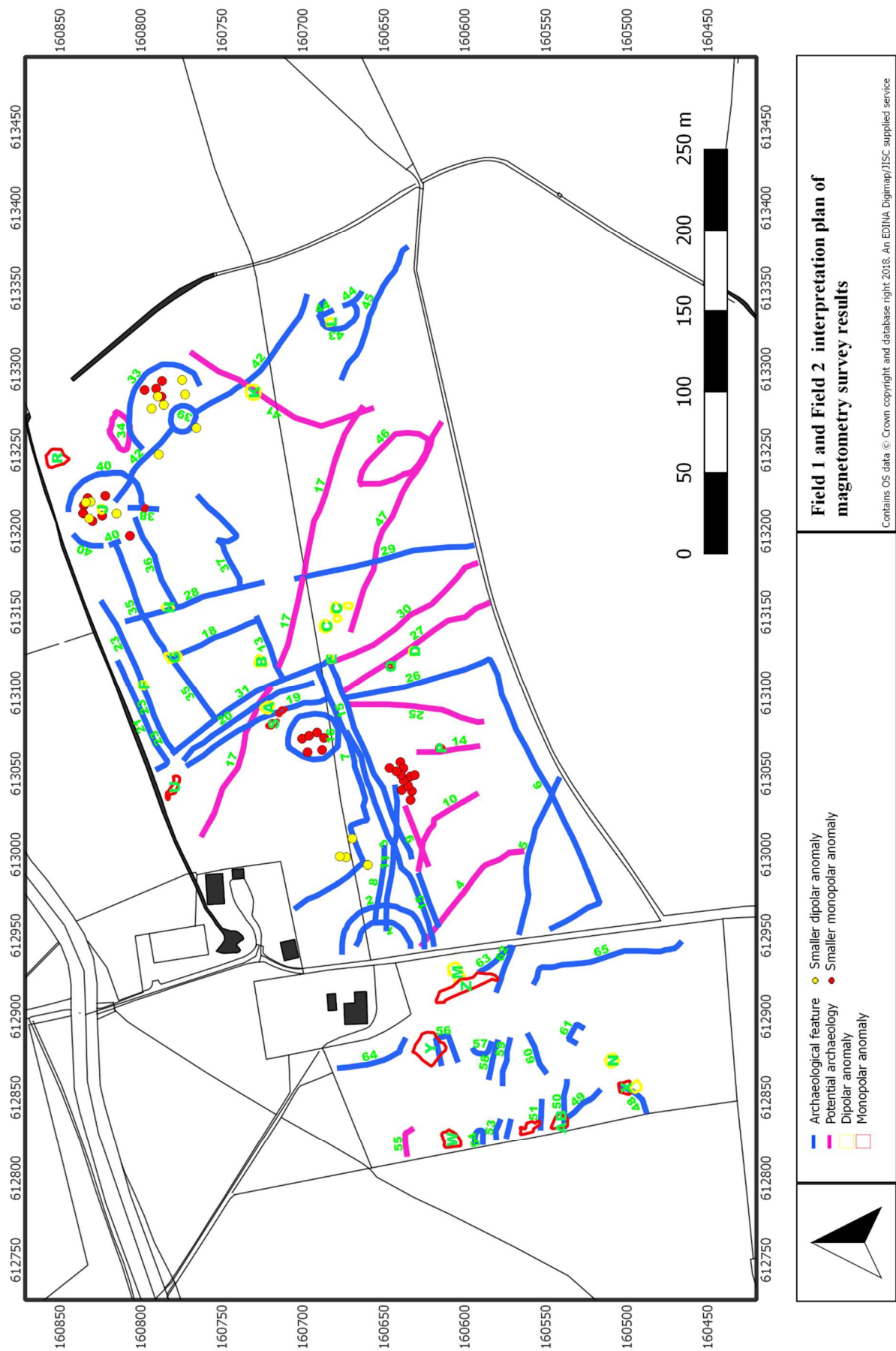


Fig. 25





Fig. 26

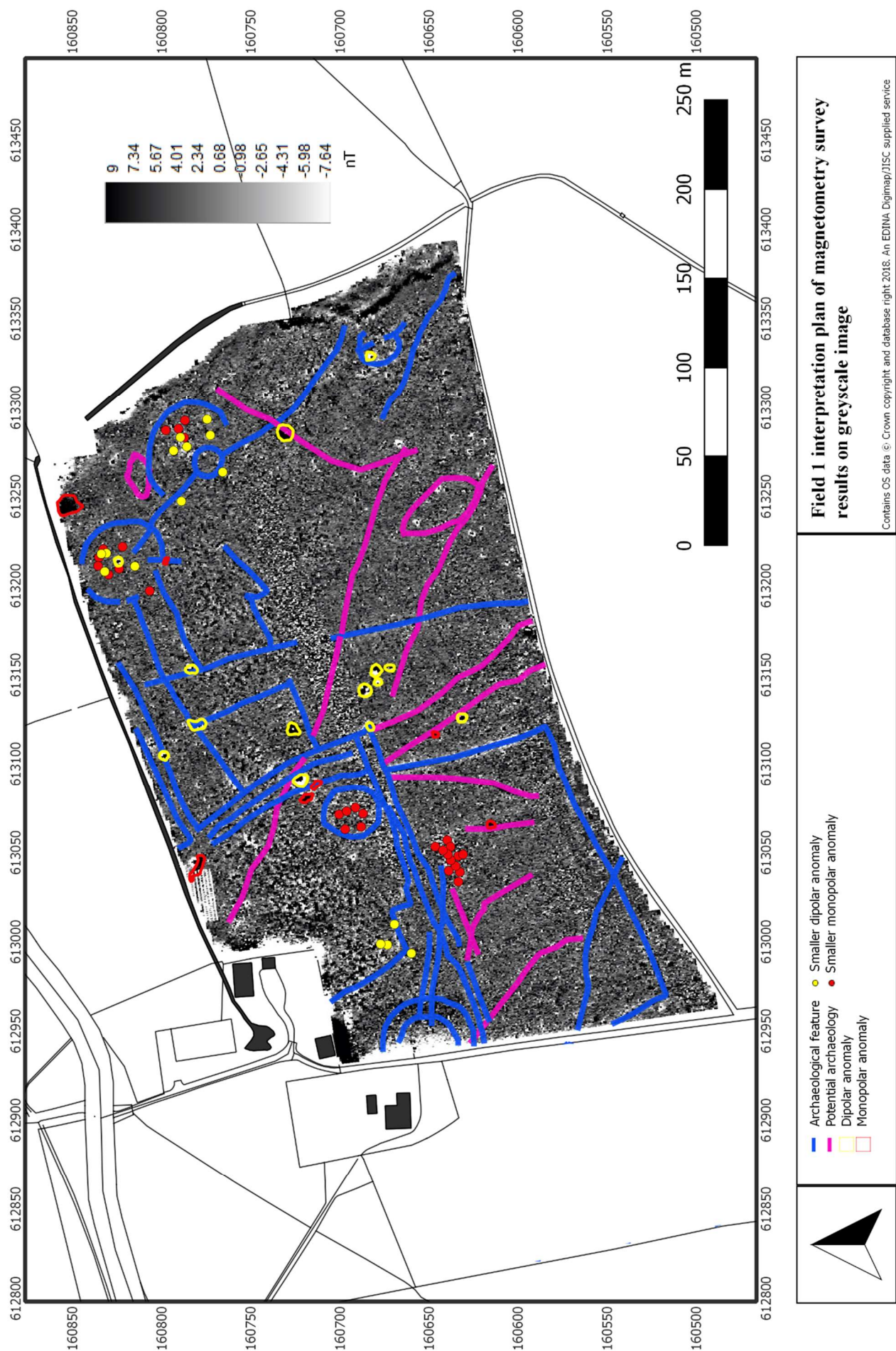


Fig. 27



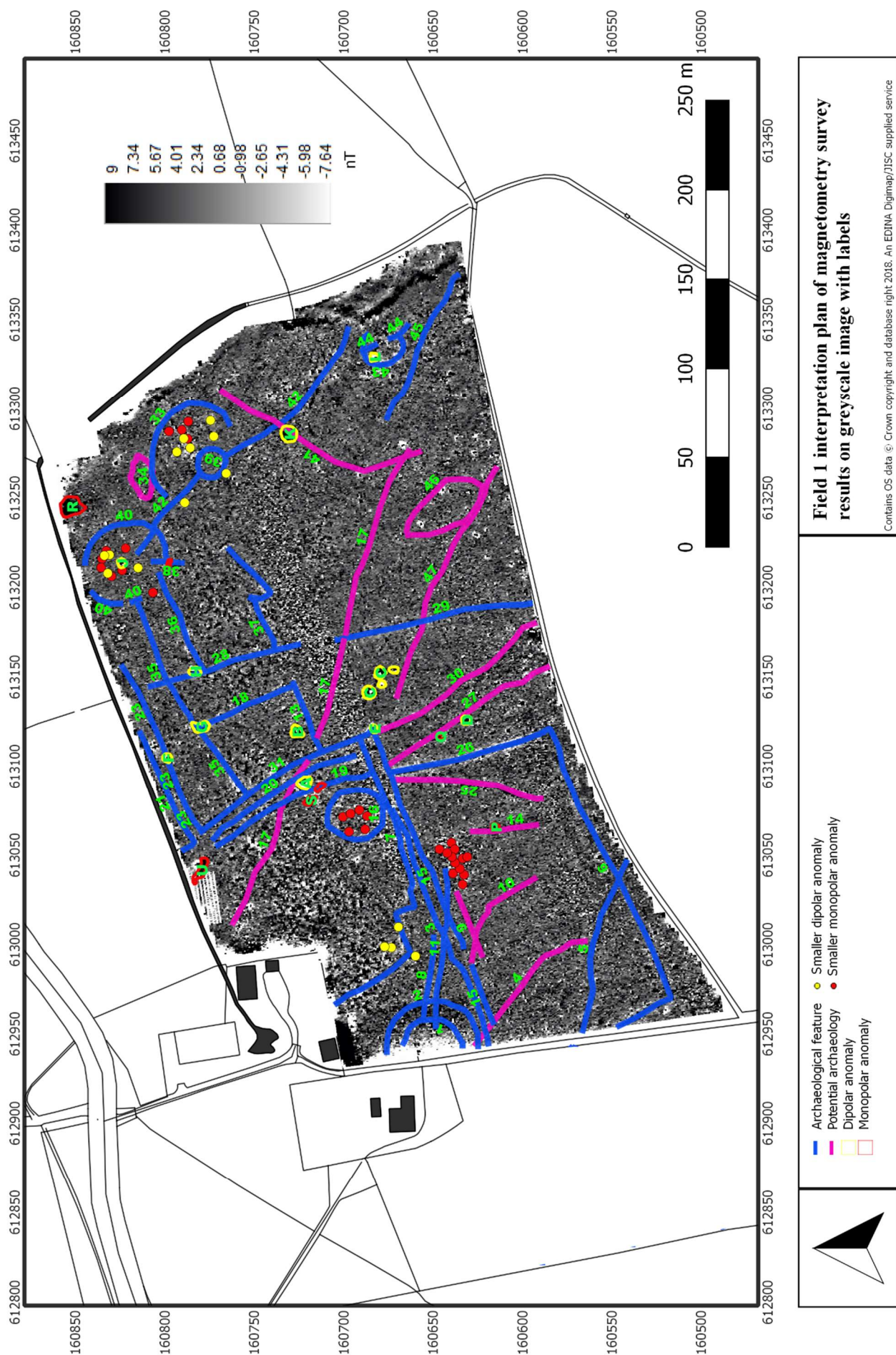
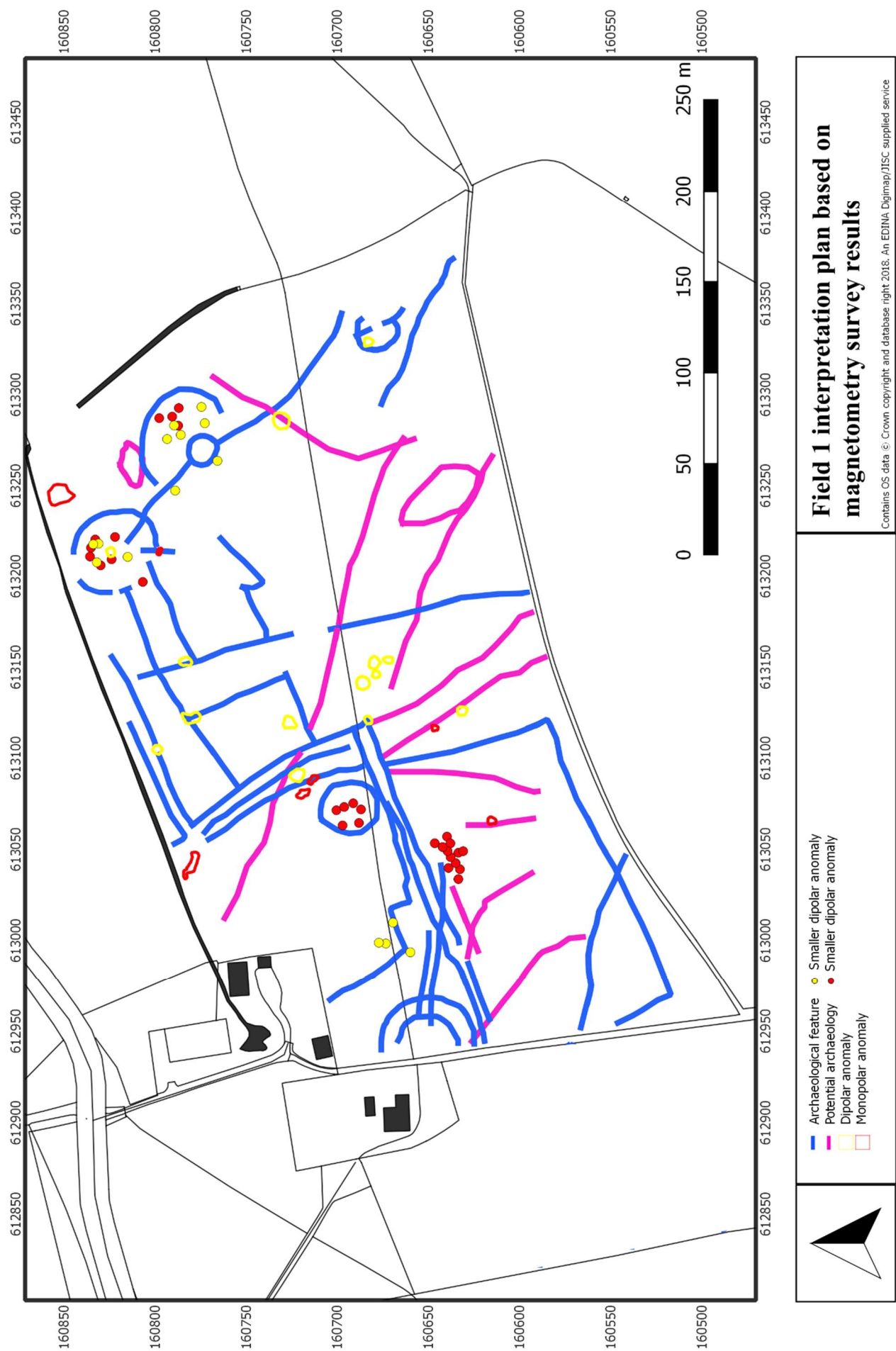


Fig. 28



62  
Fig. 29

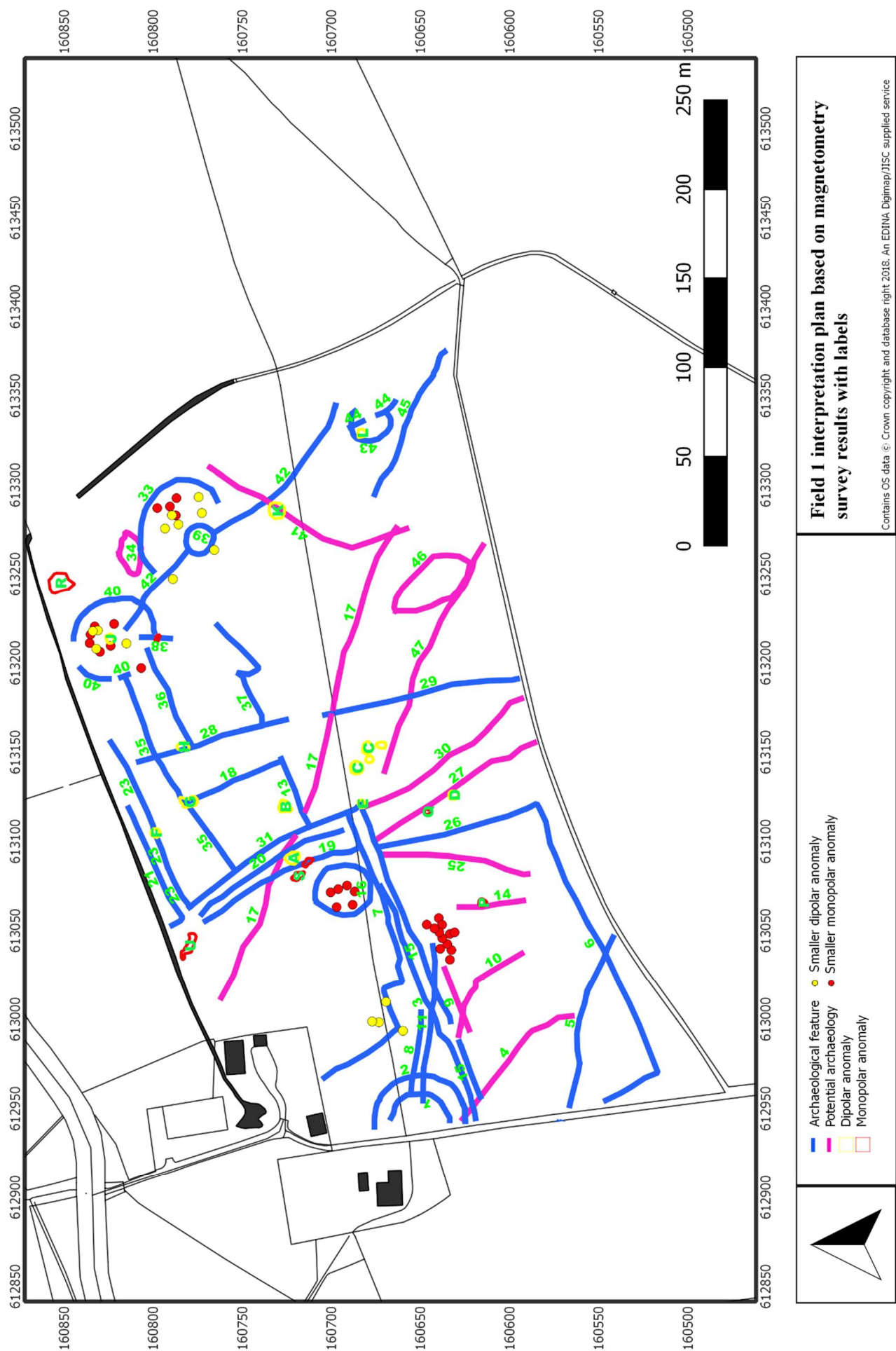


Fig. 30





Fig. 31



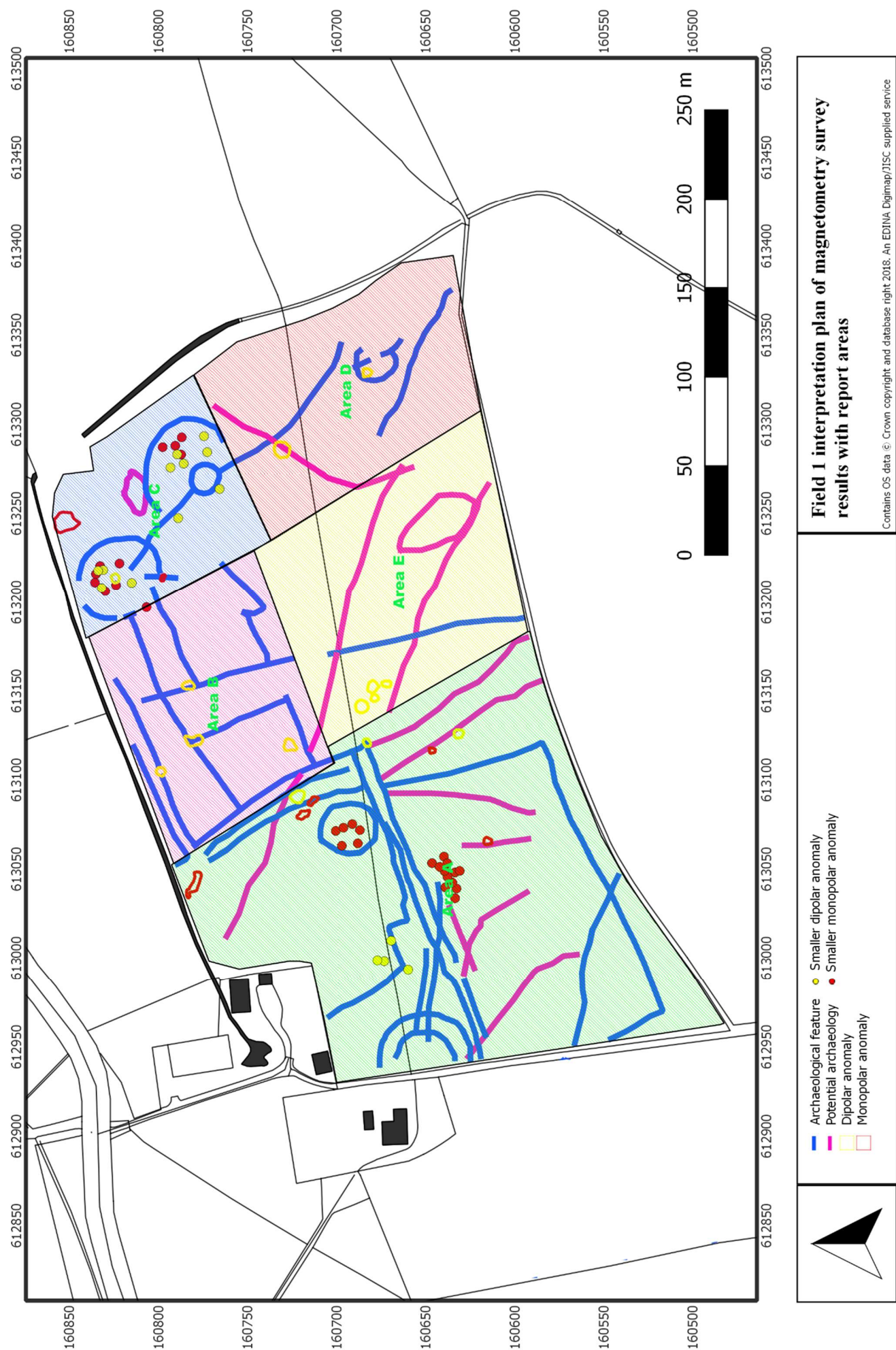


Fig. 32



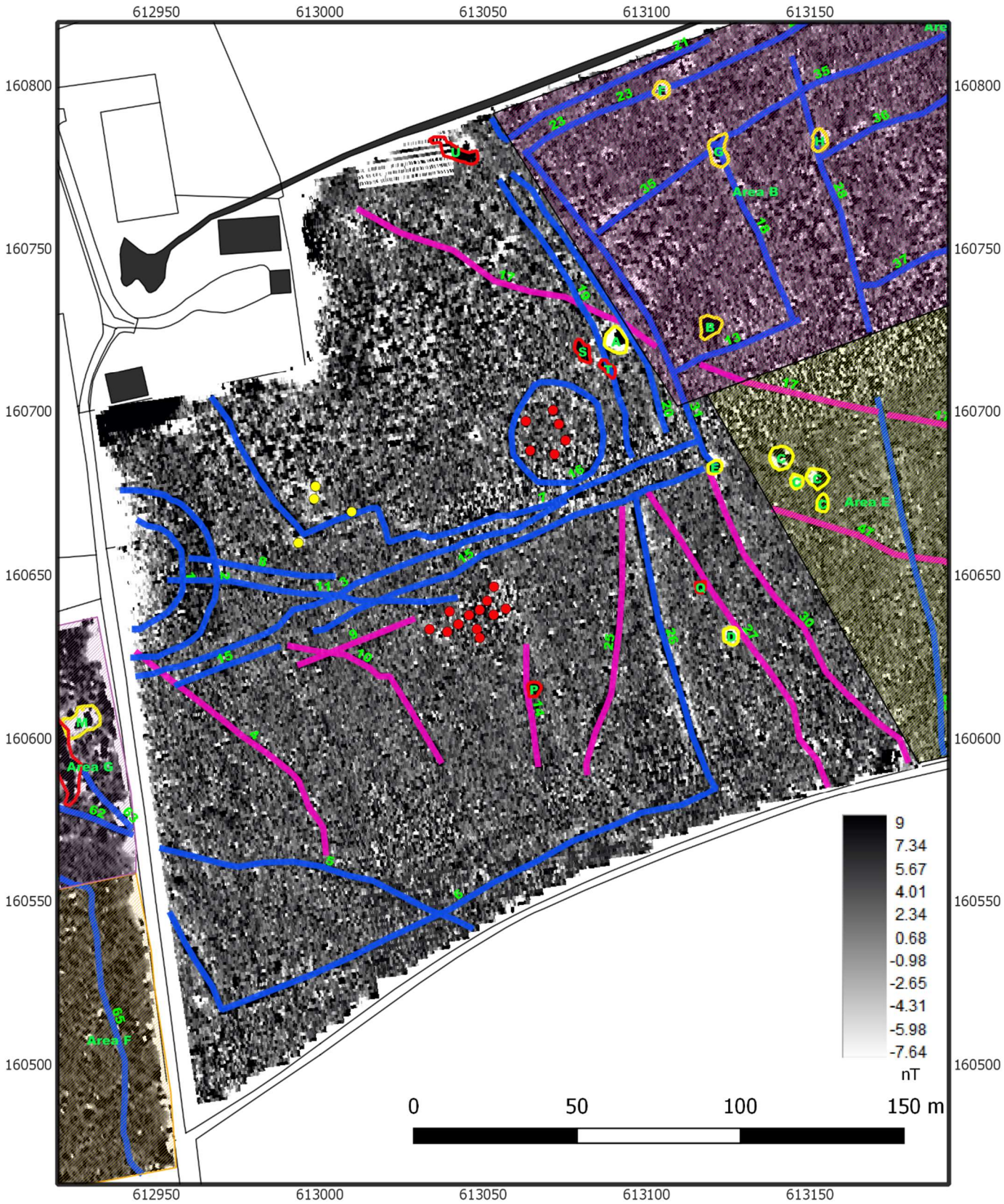


Fig. 33



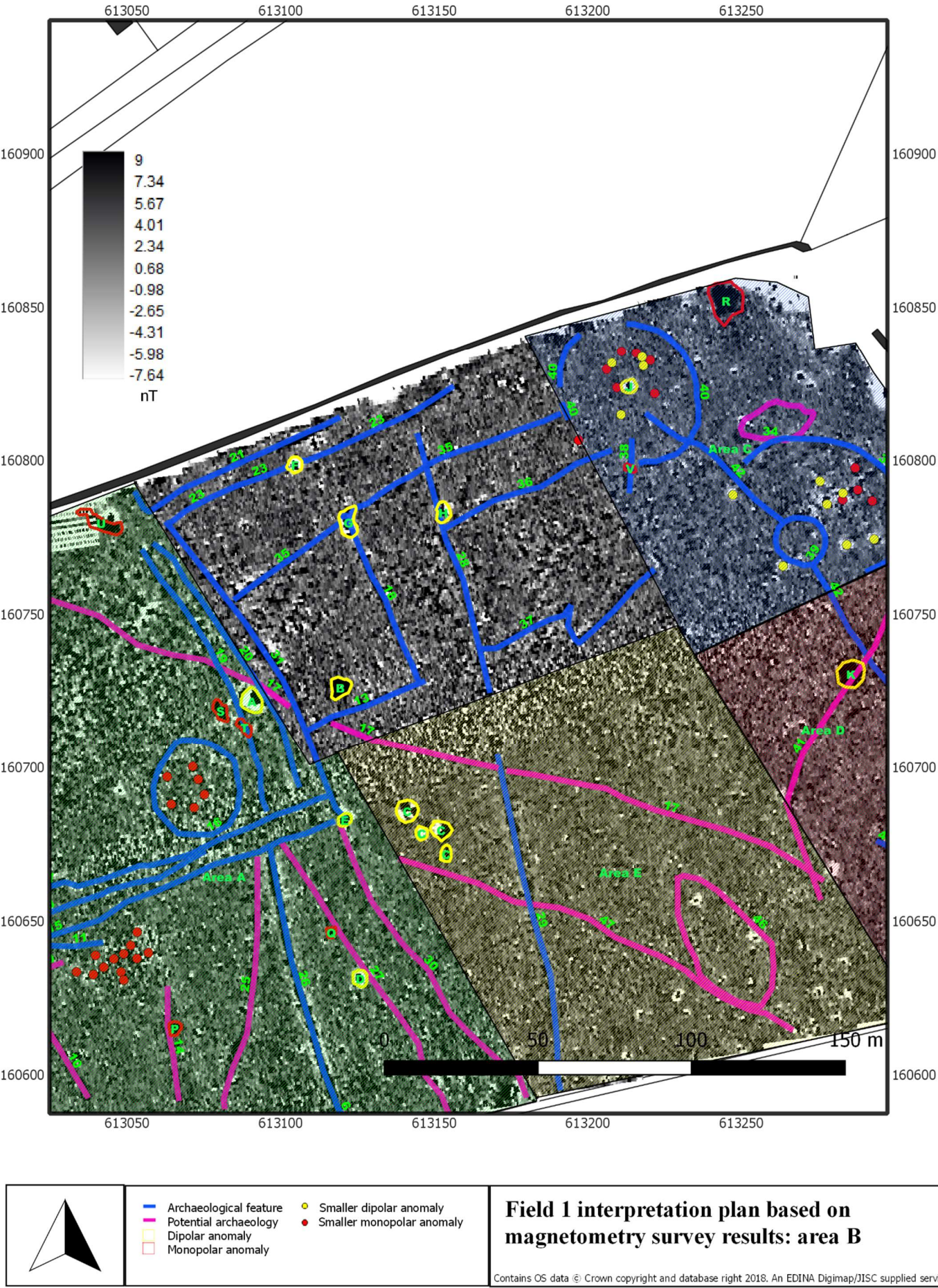


Fig. 34



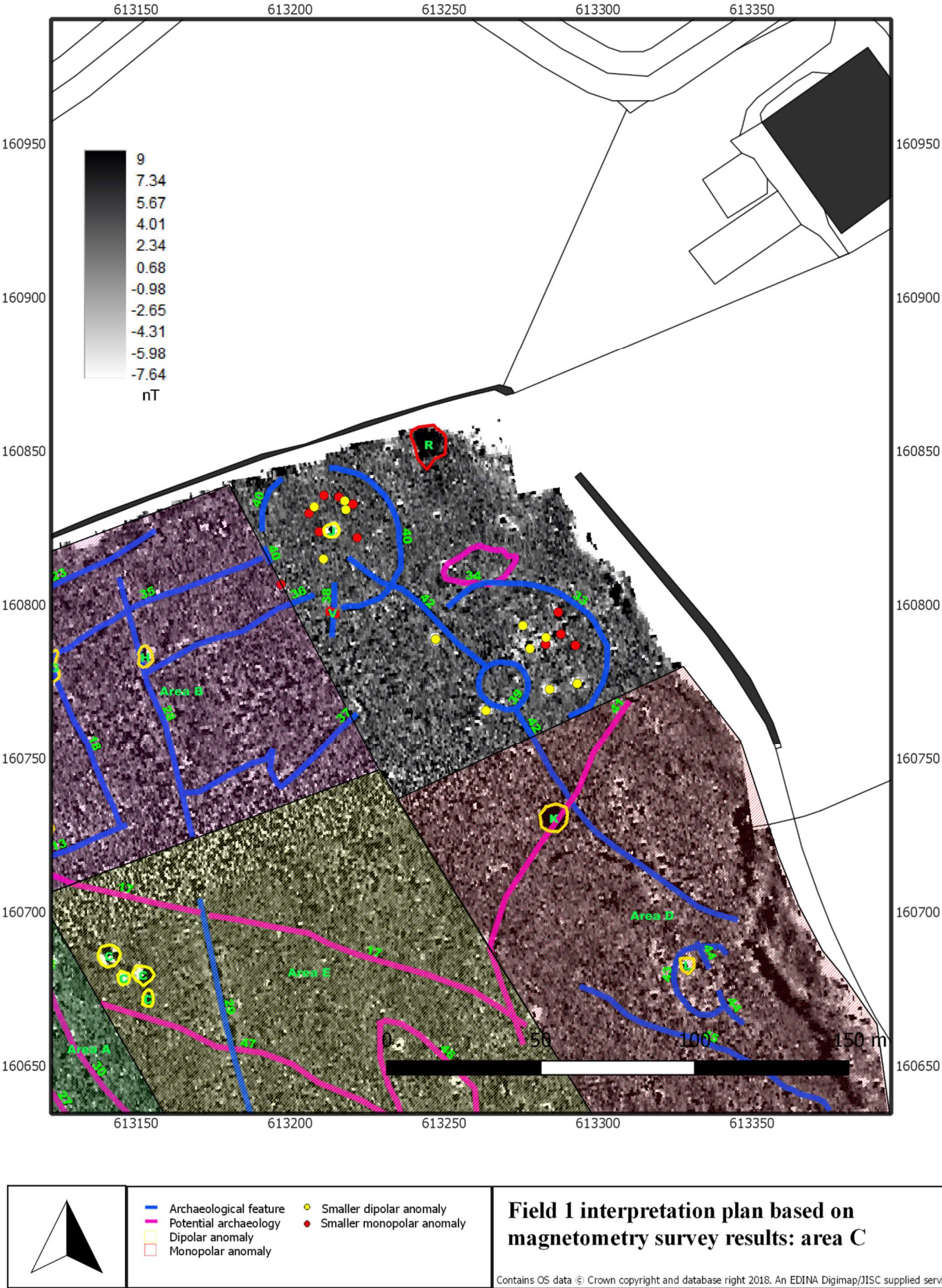


Fig. 35



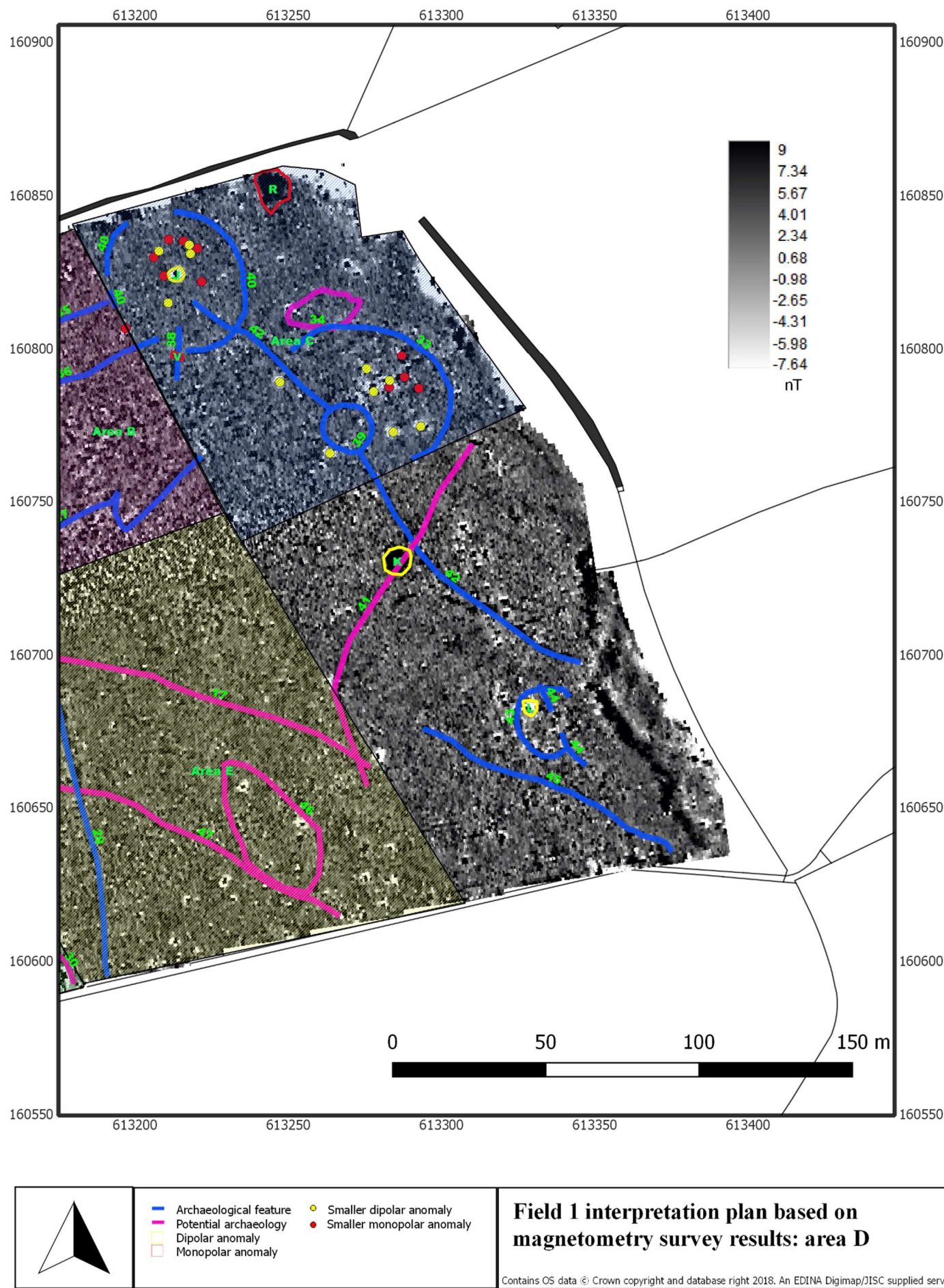


Fig. 36



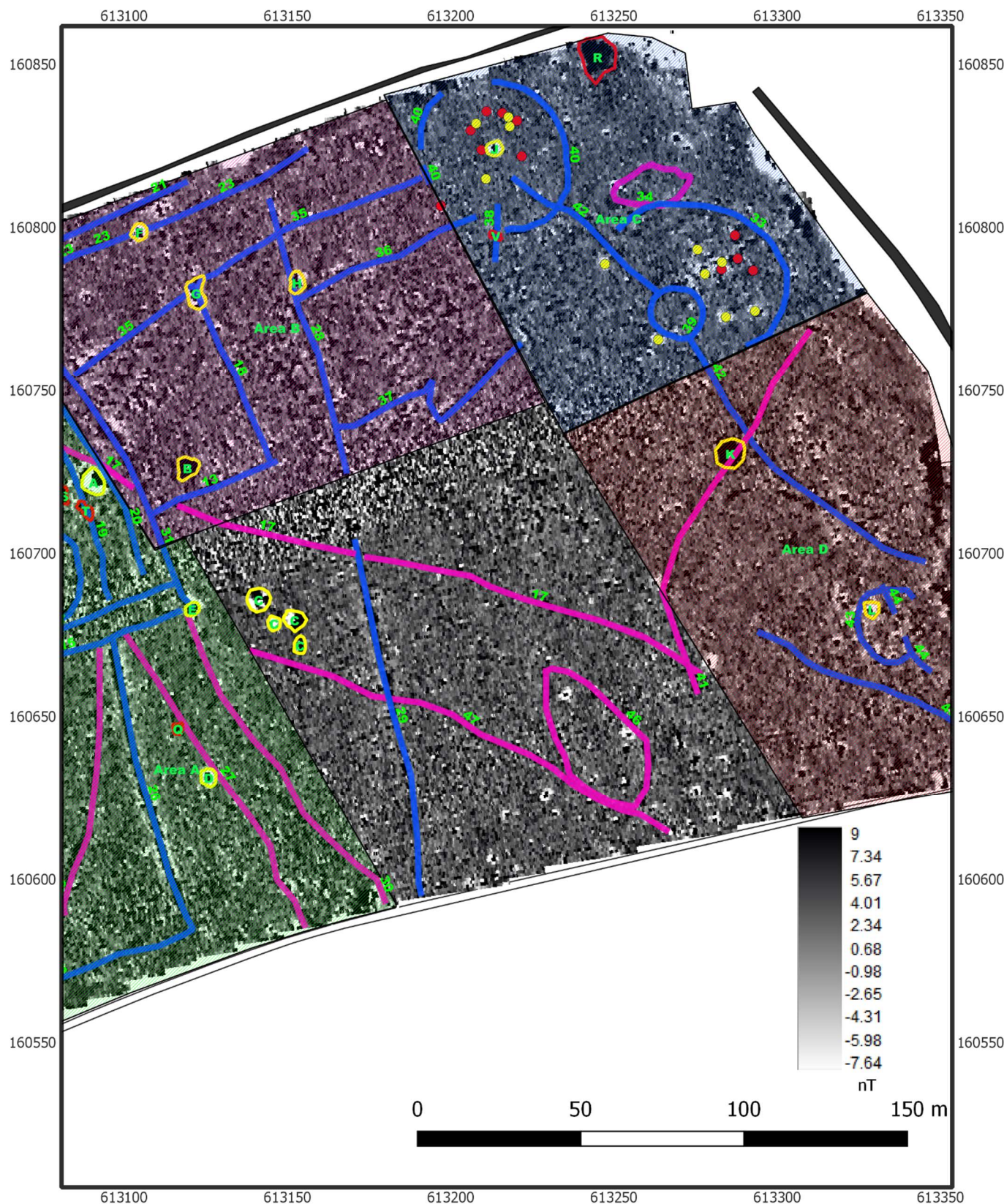


Fig. 37

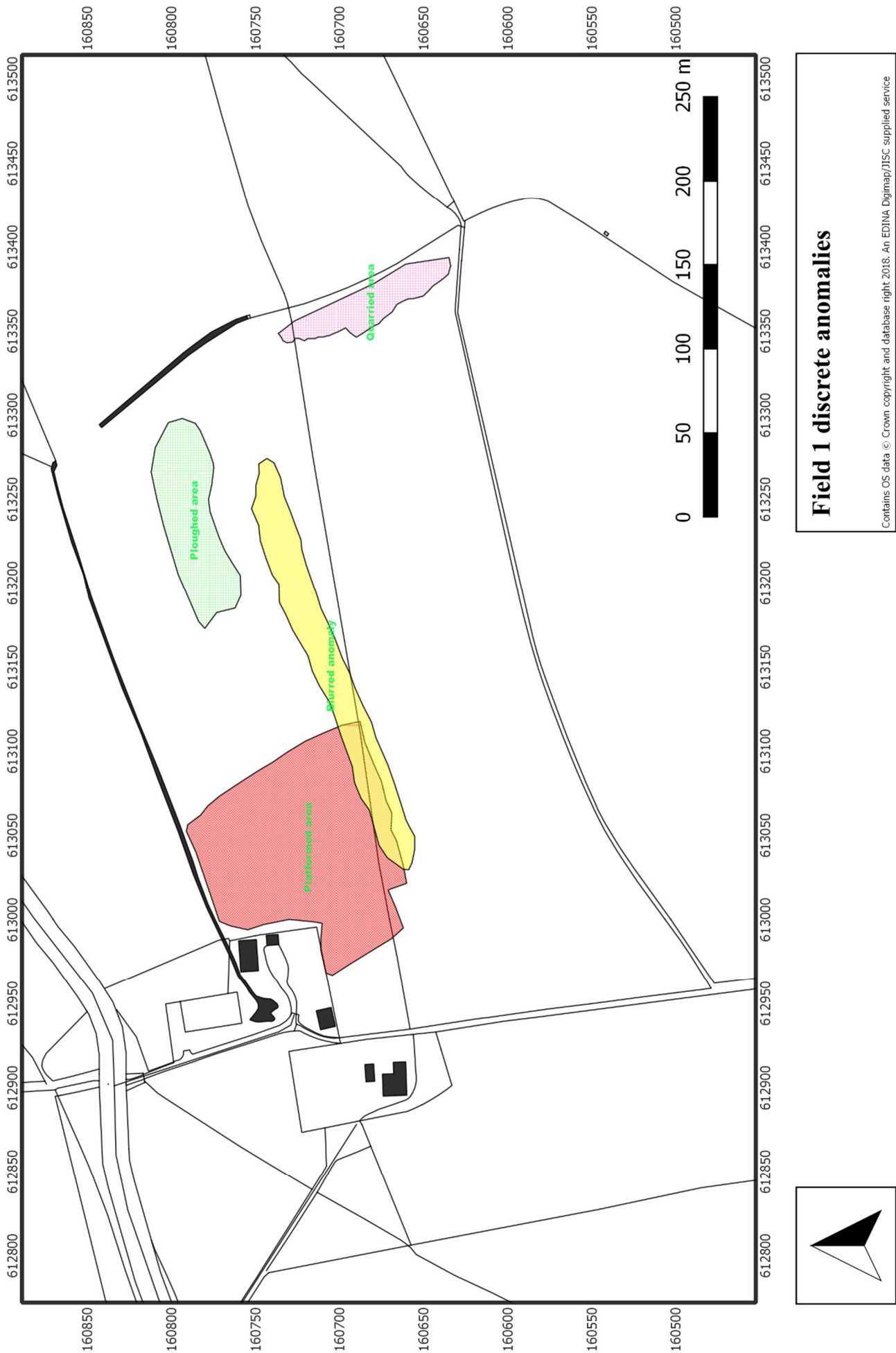


Fig. 38



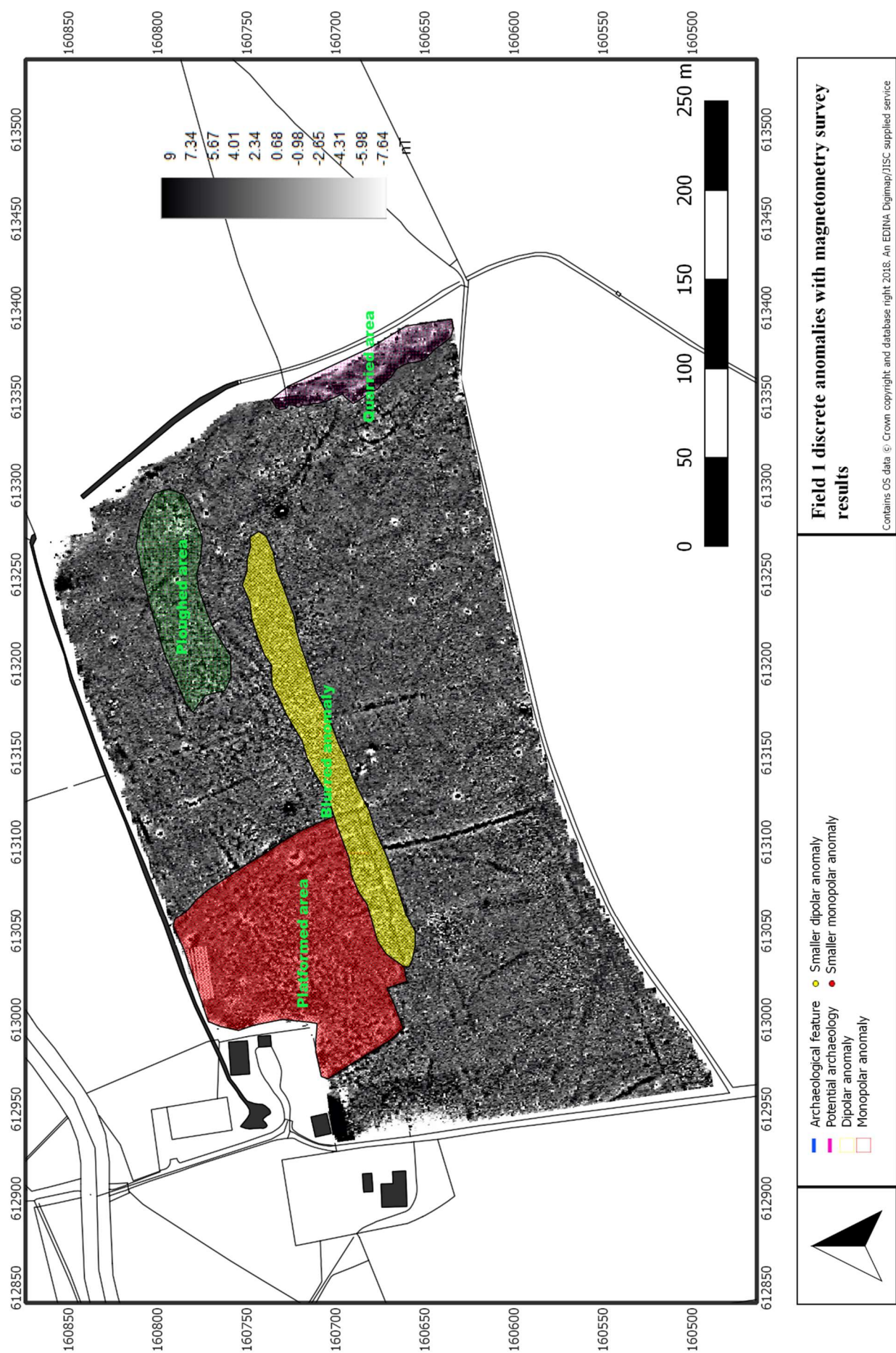


Fig. 39



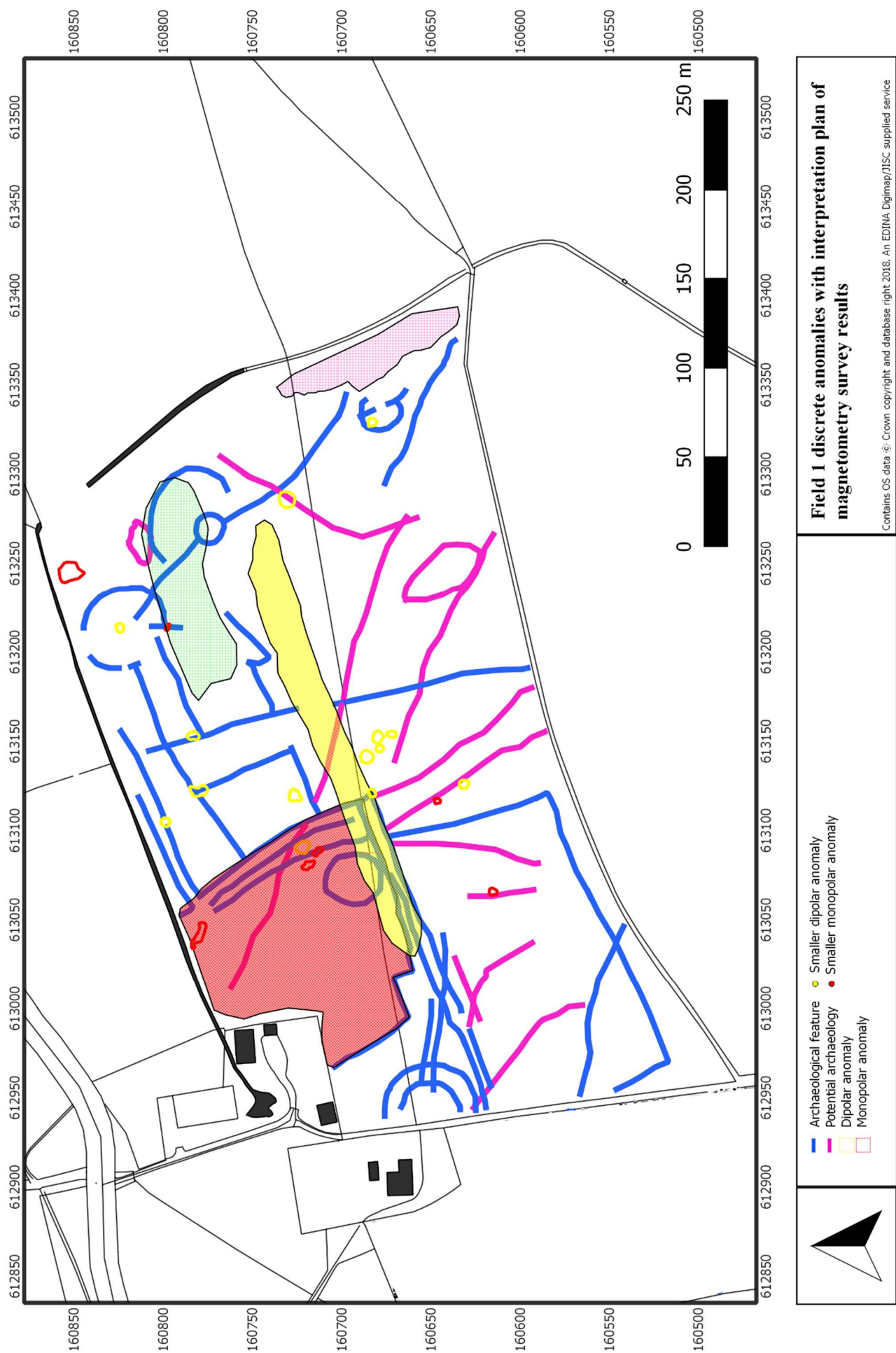


Fig. 40



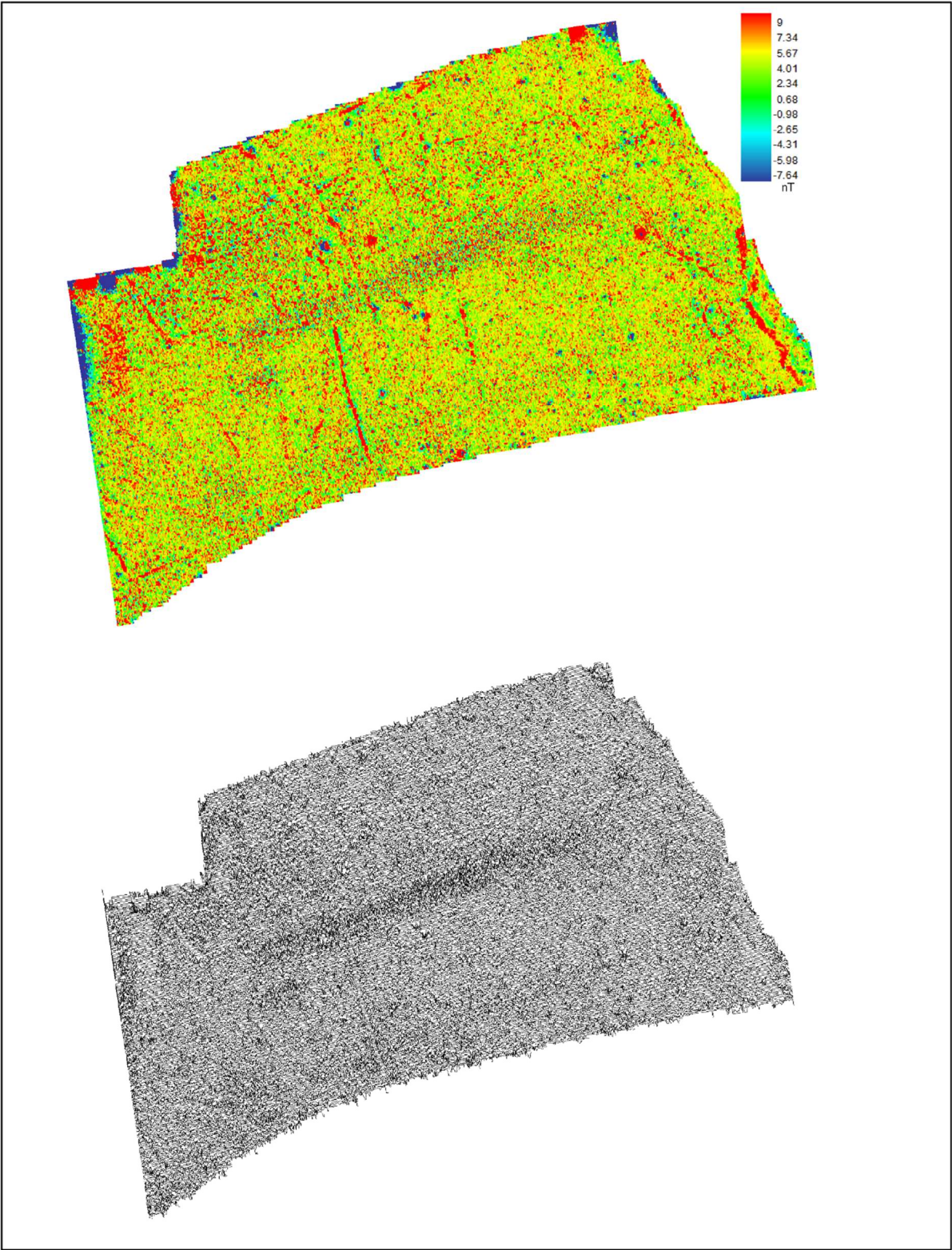


Fig. 41





**Fig. 42: Burnt hay bale producing anomalous result [K]**



Field 1 magnetometry survey results:  
colour shade and traceplot

Fig. 43





**Field 2 magnetometry survey results - processed**

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**Fig. 44**

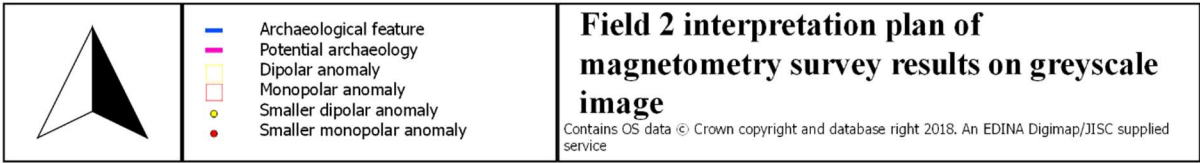
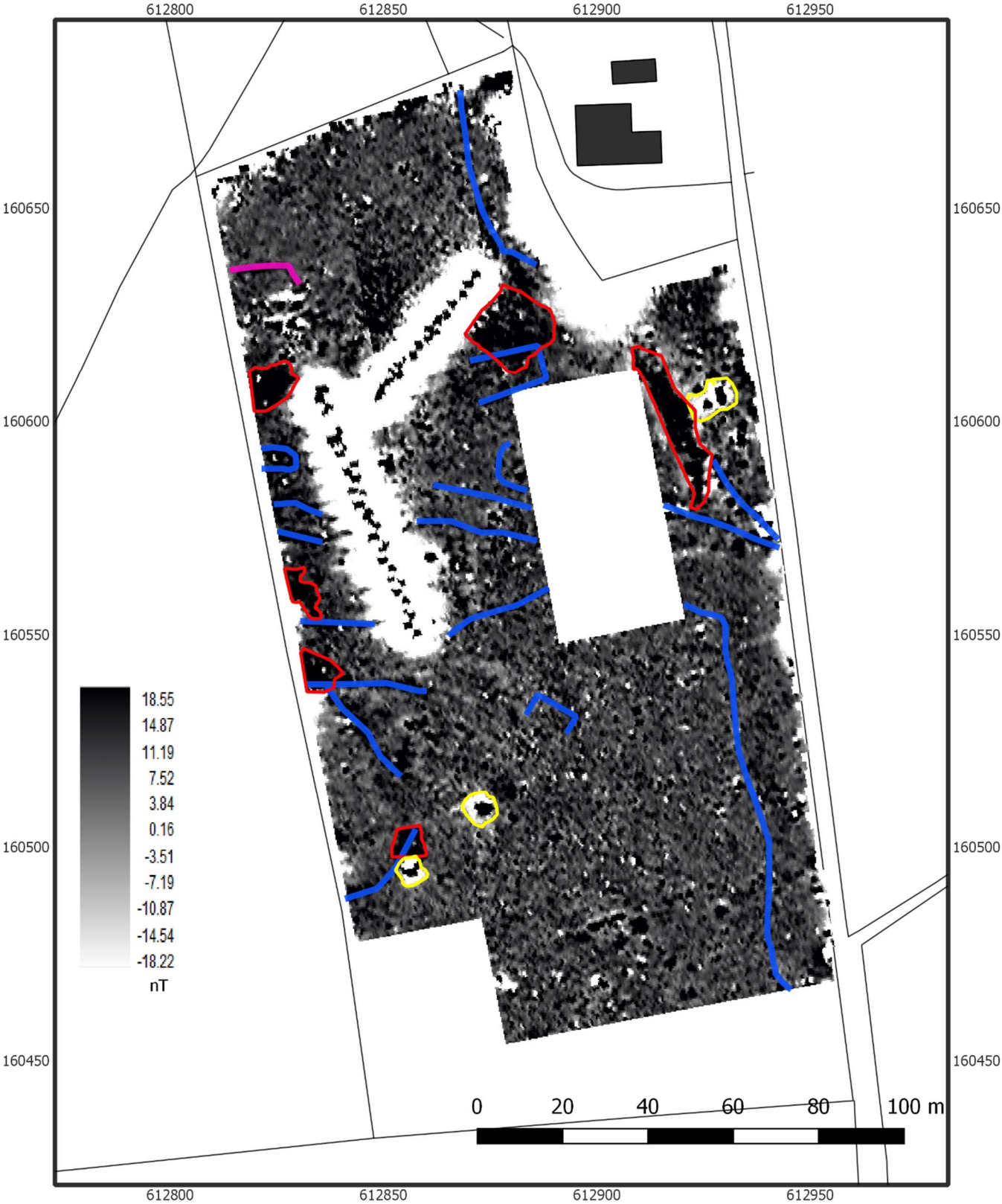


Fig. 45



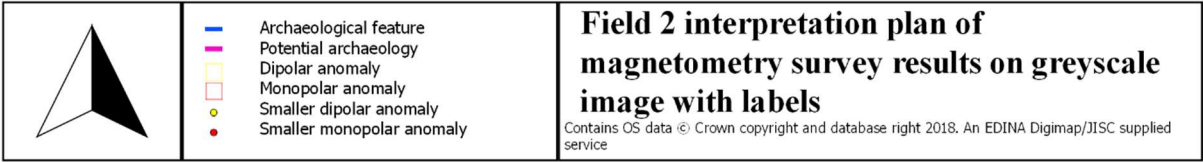
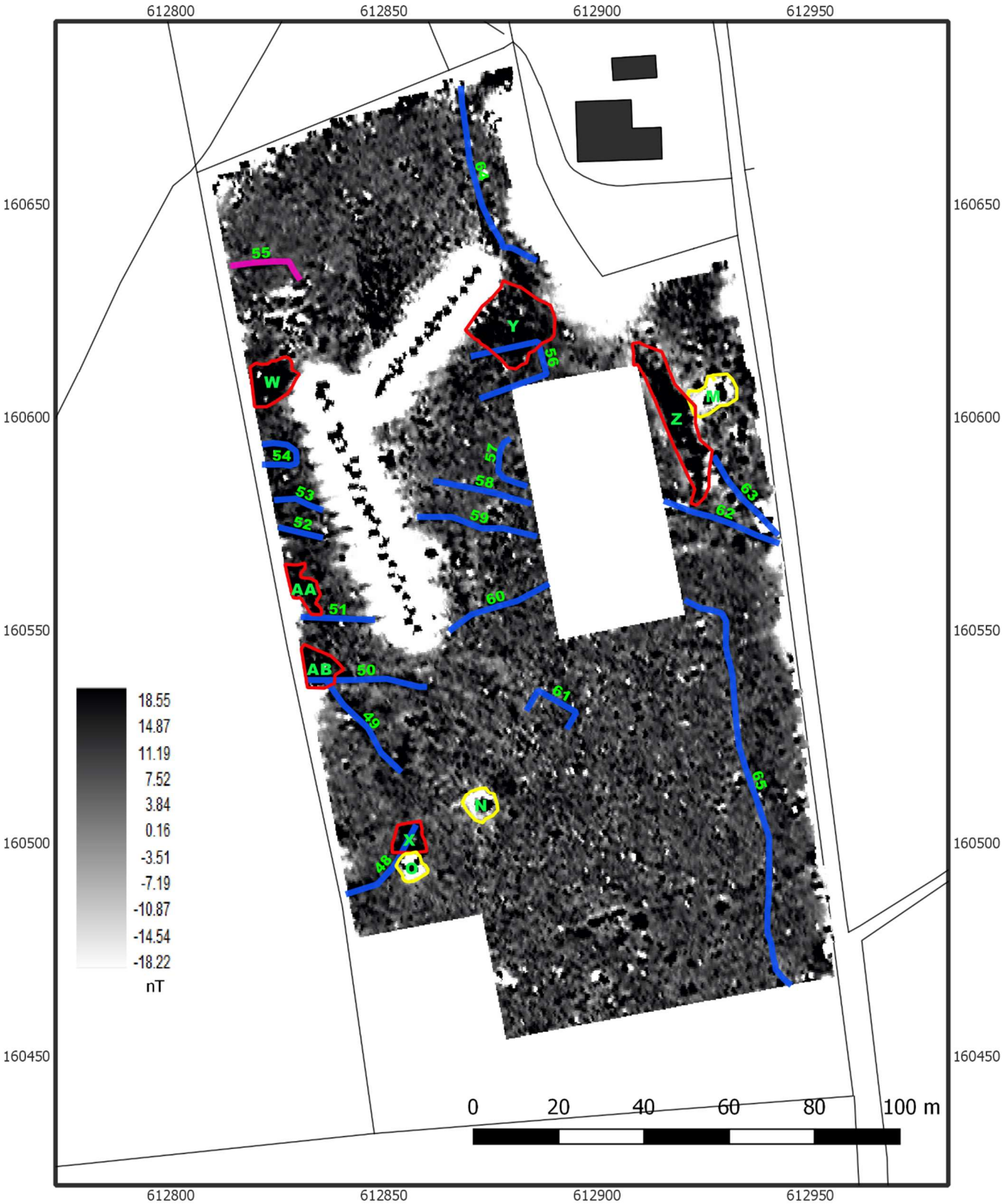


Fig. 46

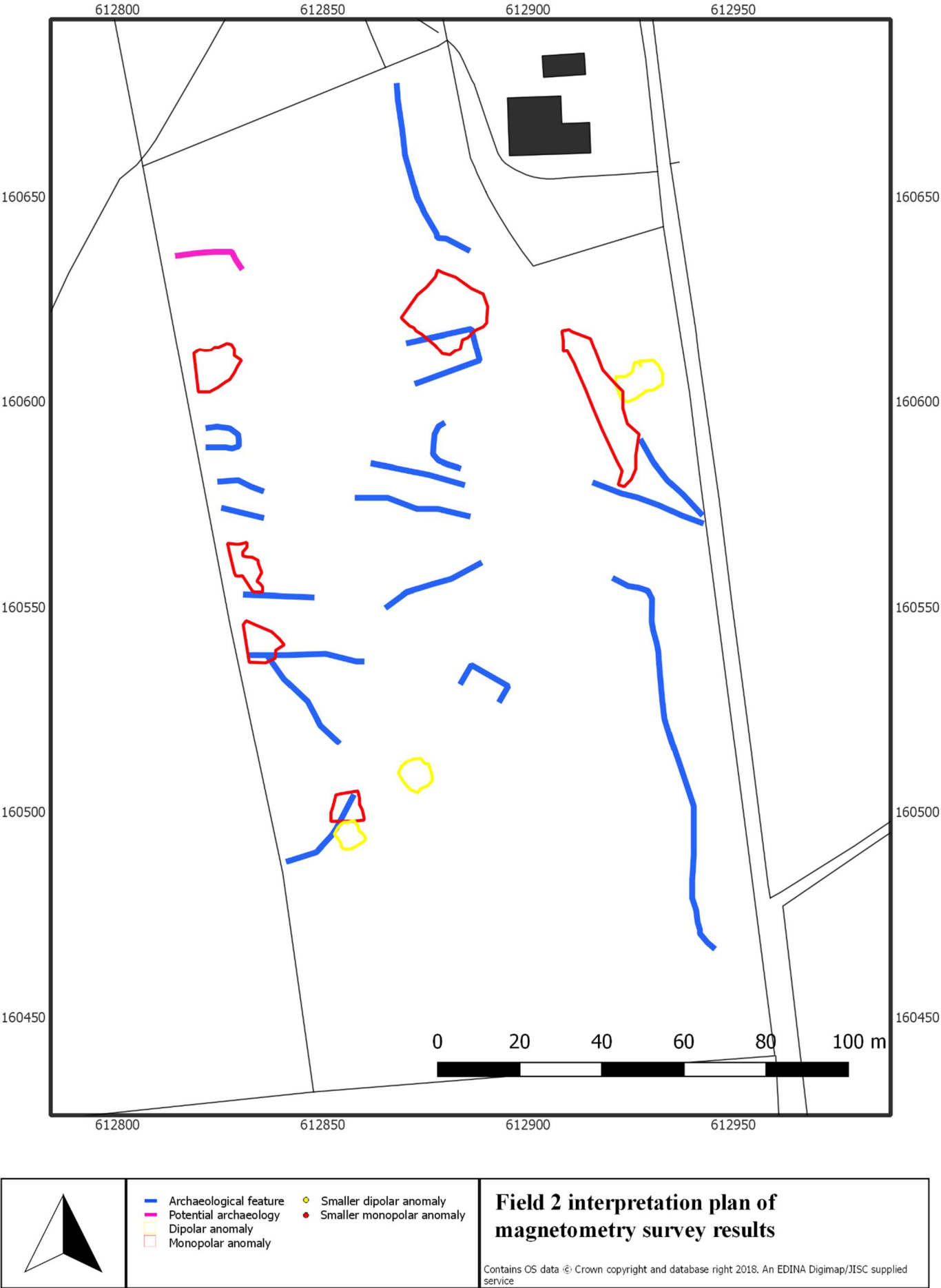


Fig. 47

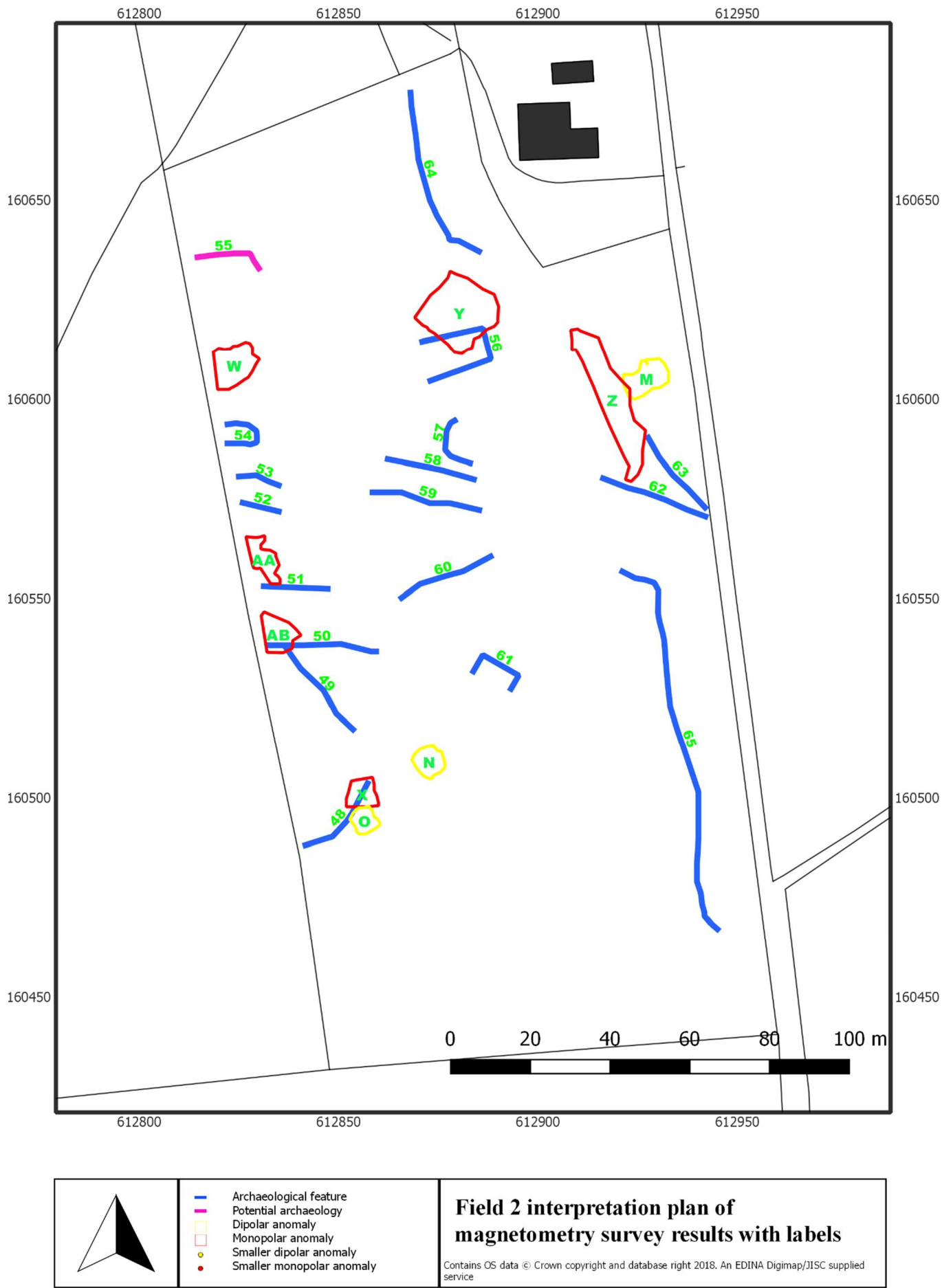


Fig. 48



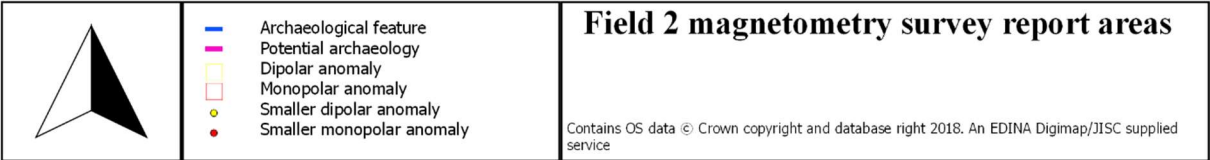
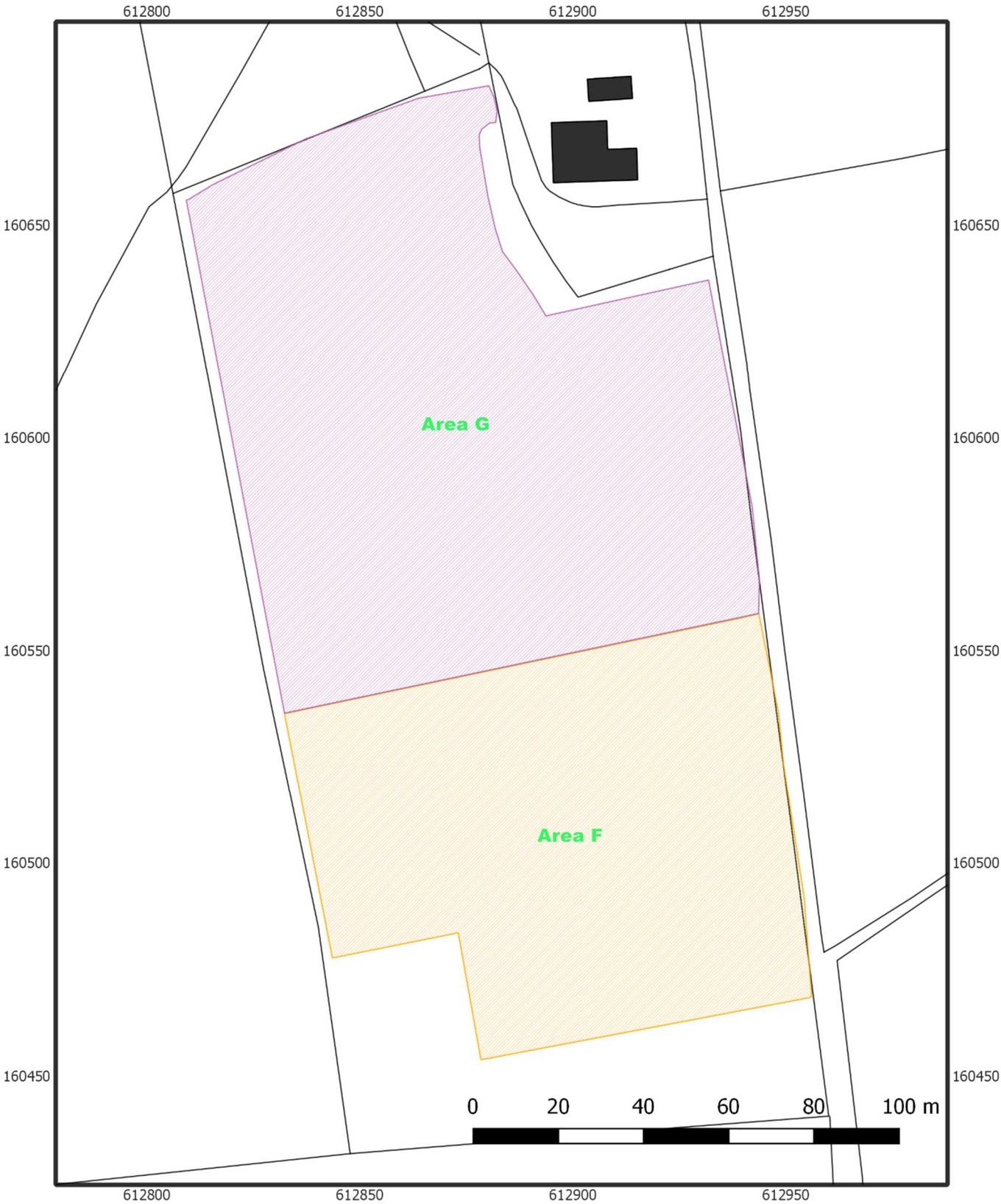


Fig. 49

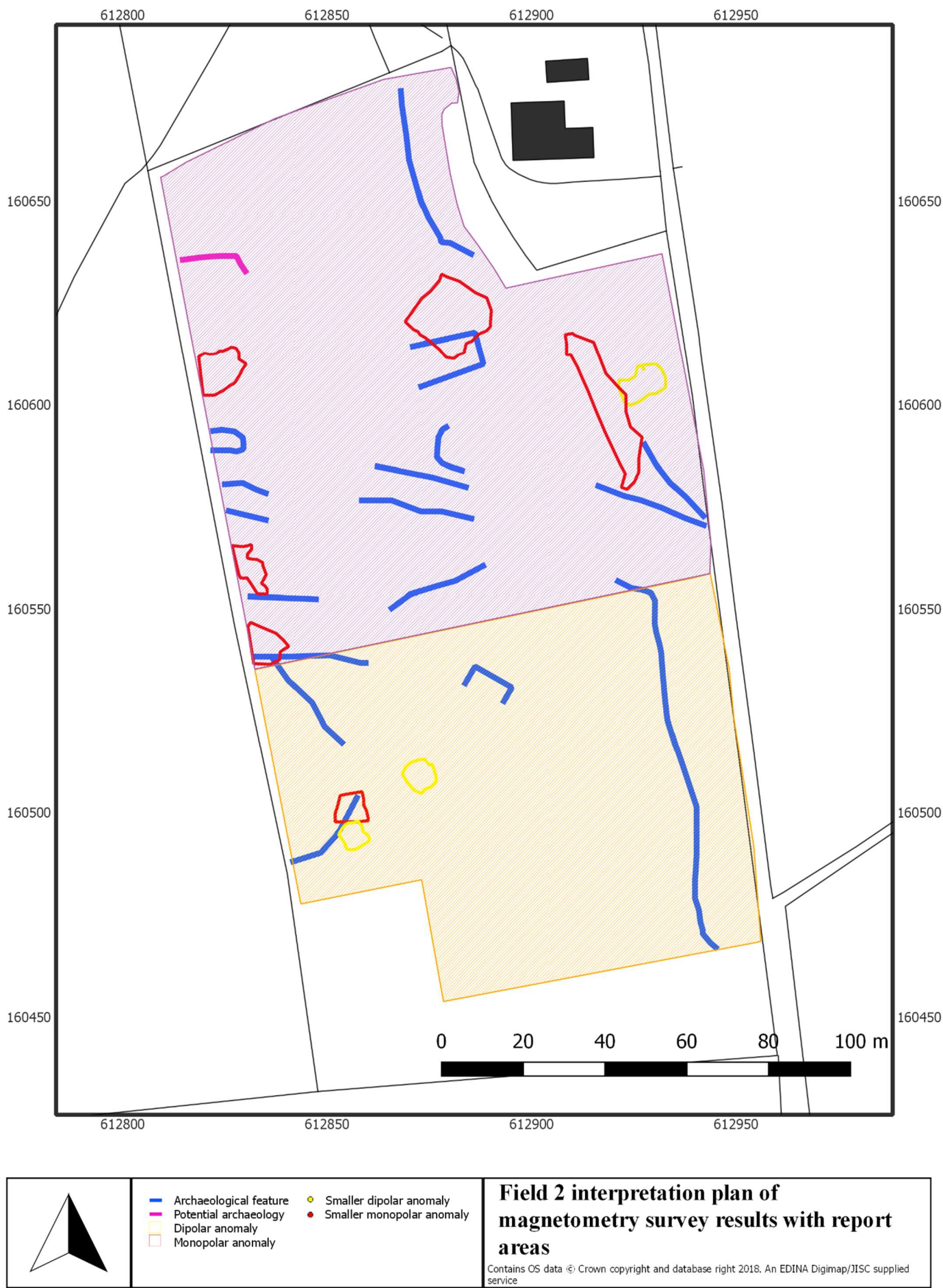


Fig. 50



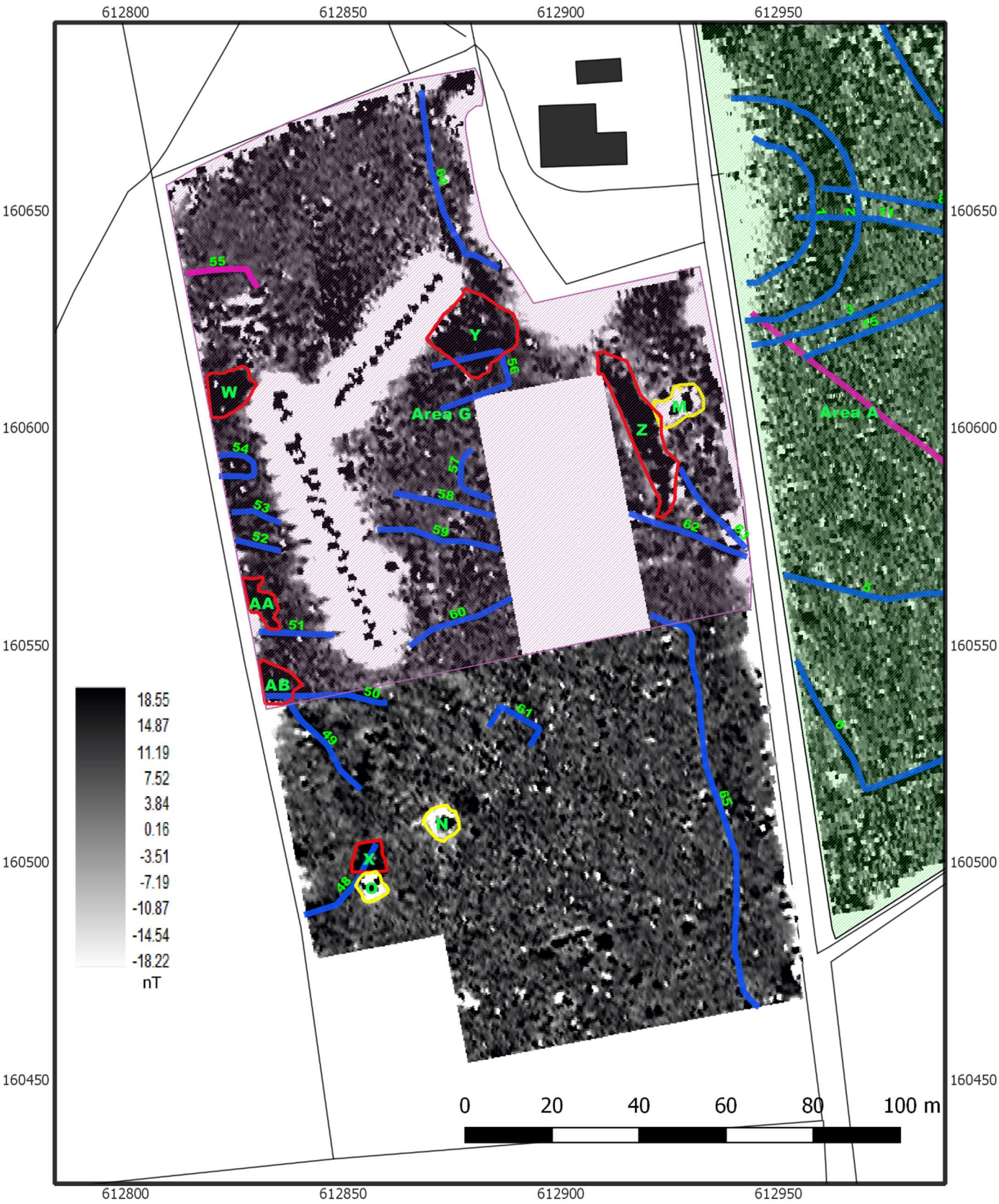


Fig. 51



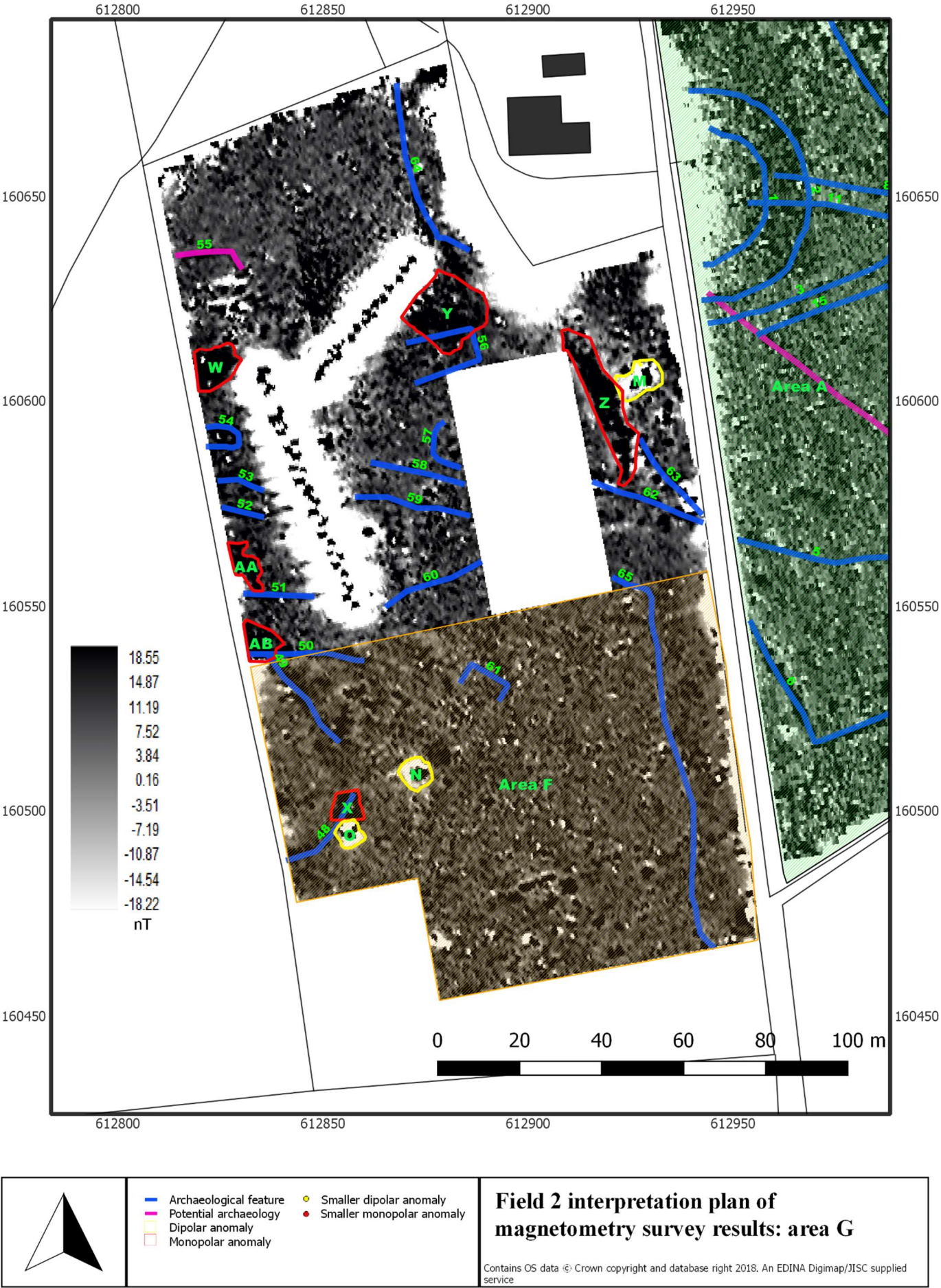


Fig. 52

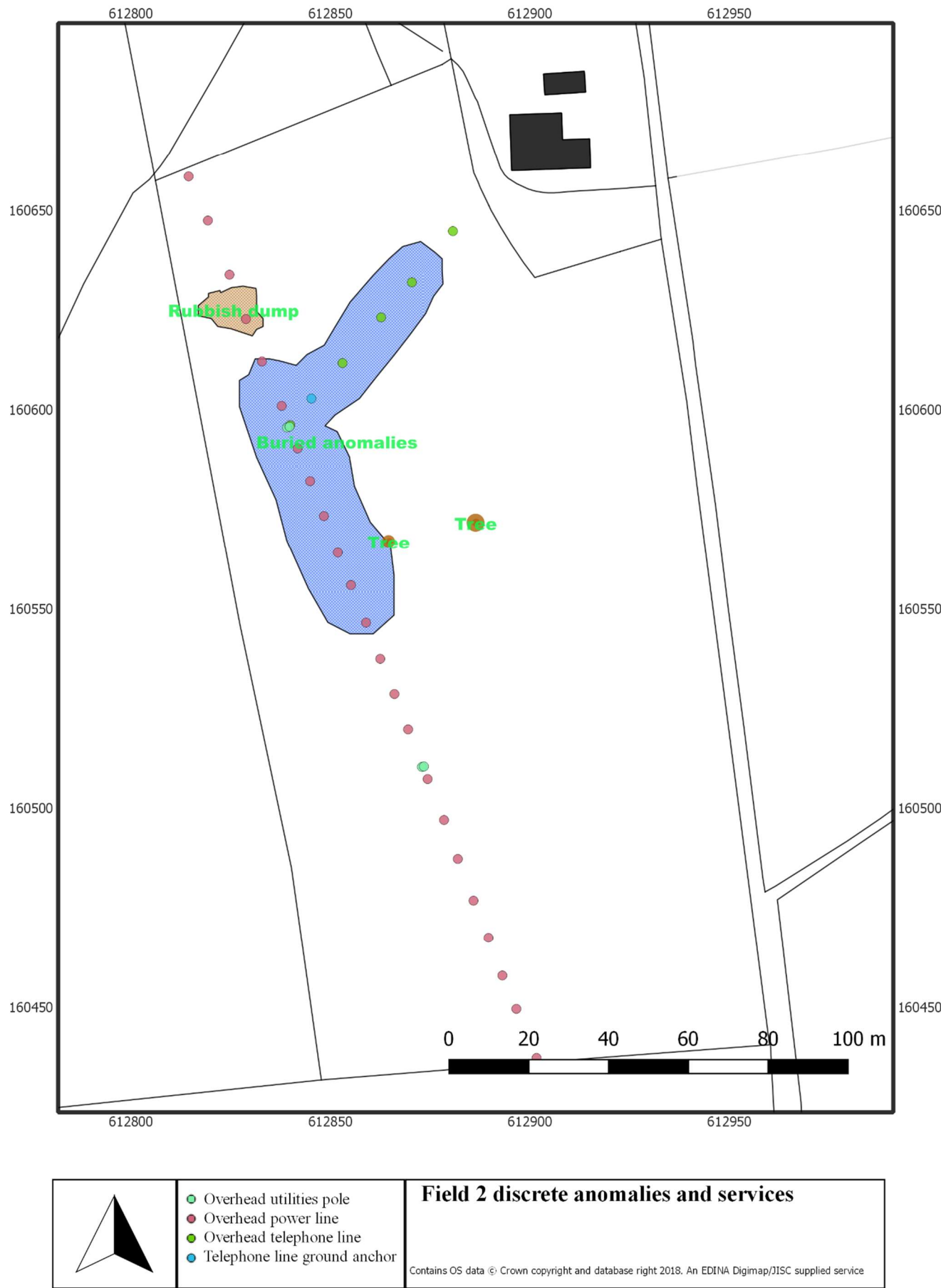


Fig. 53



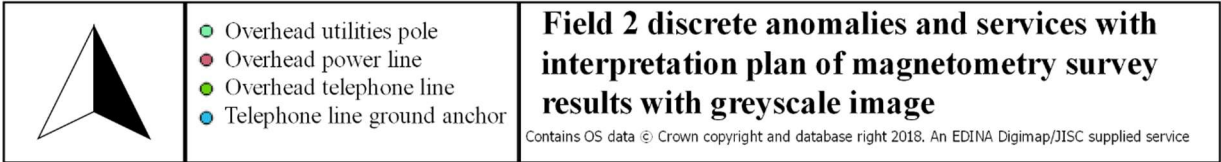
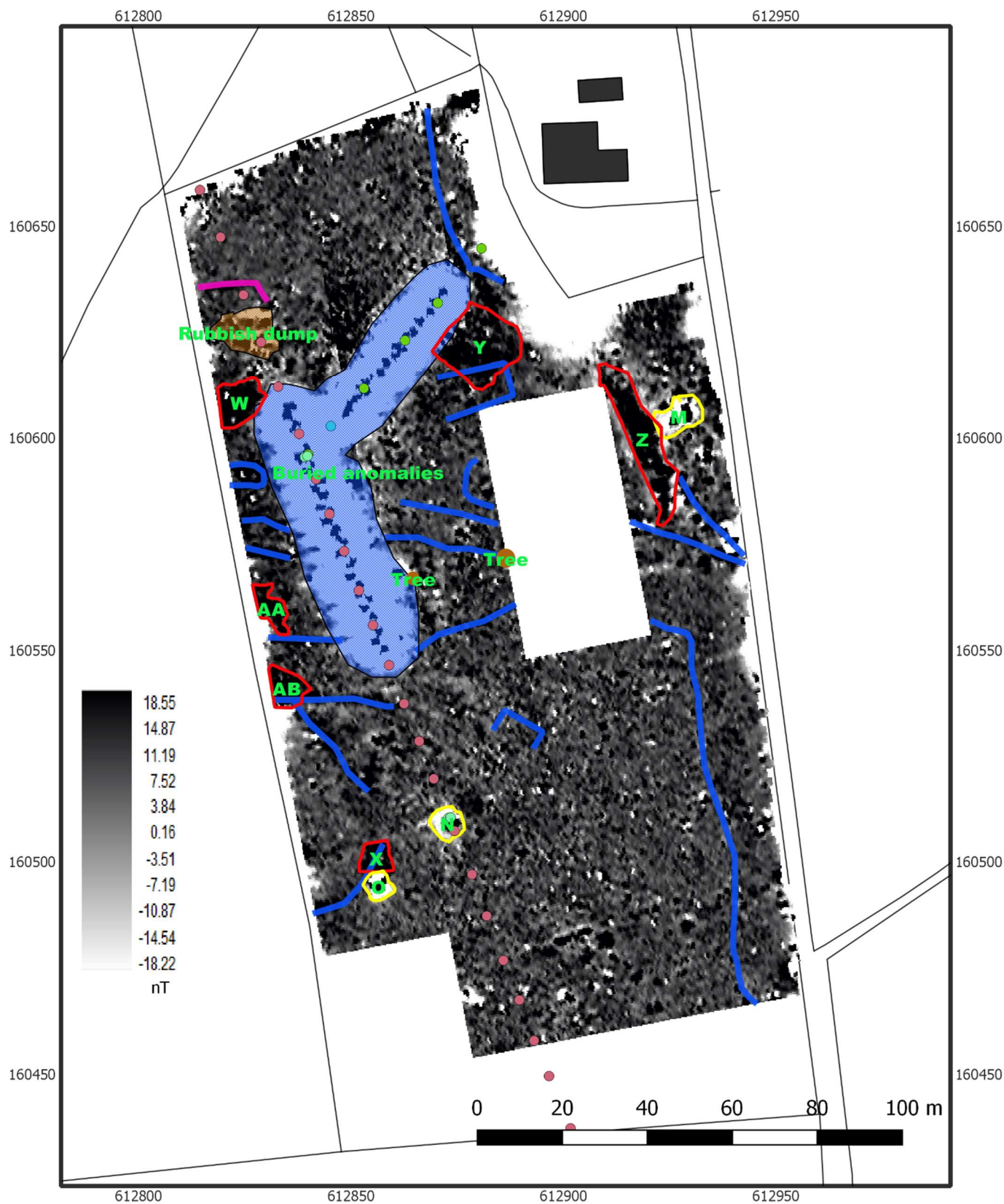


Fig. 54



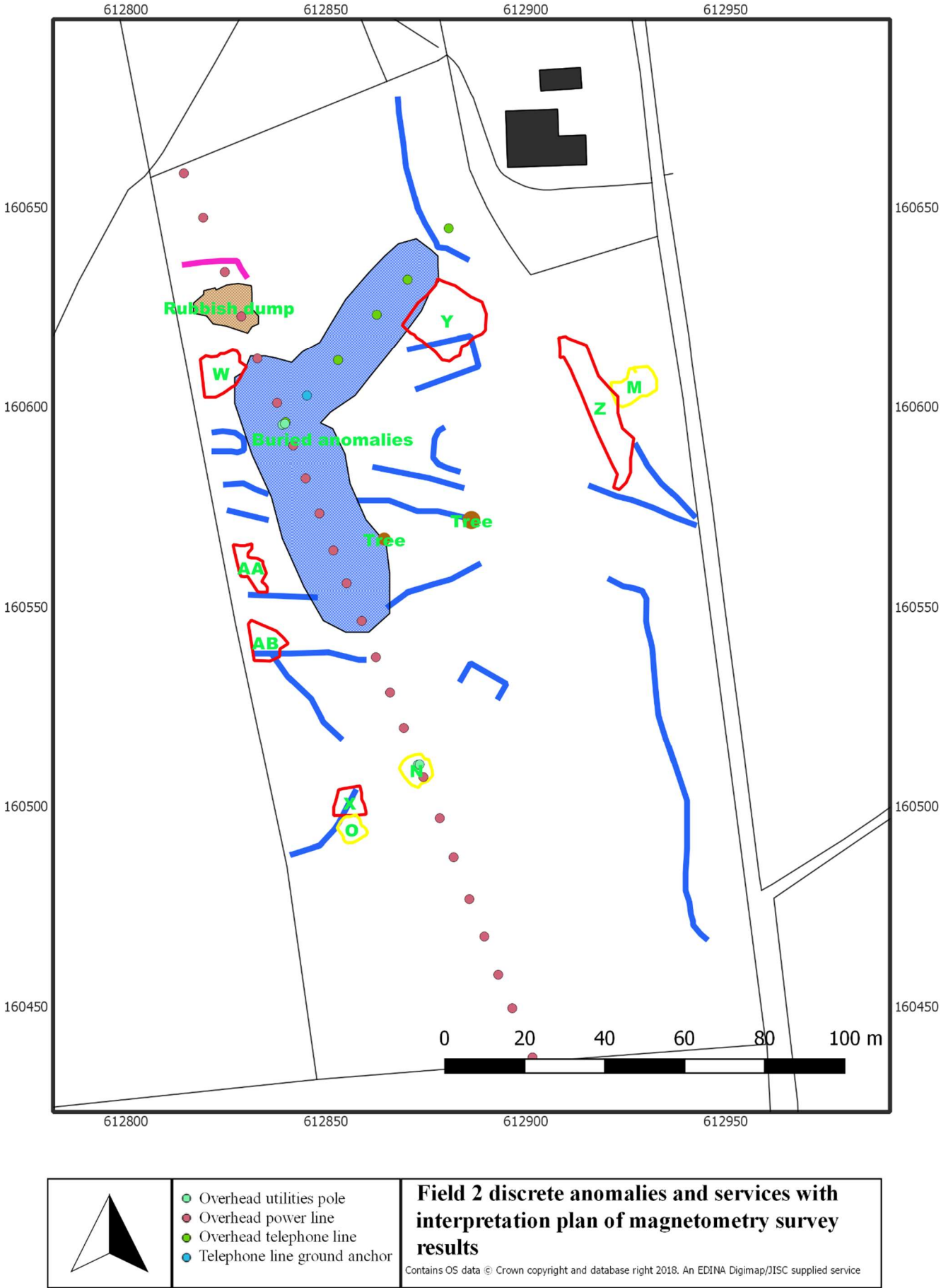
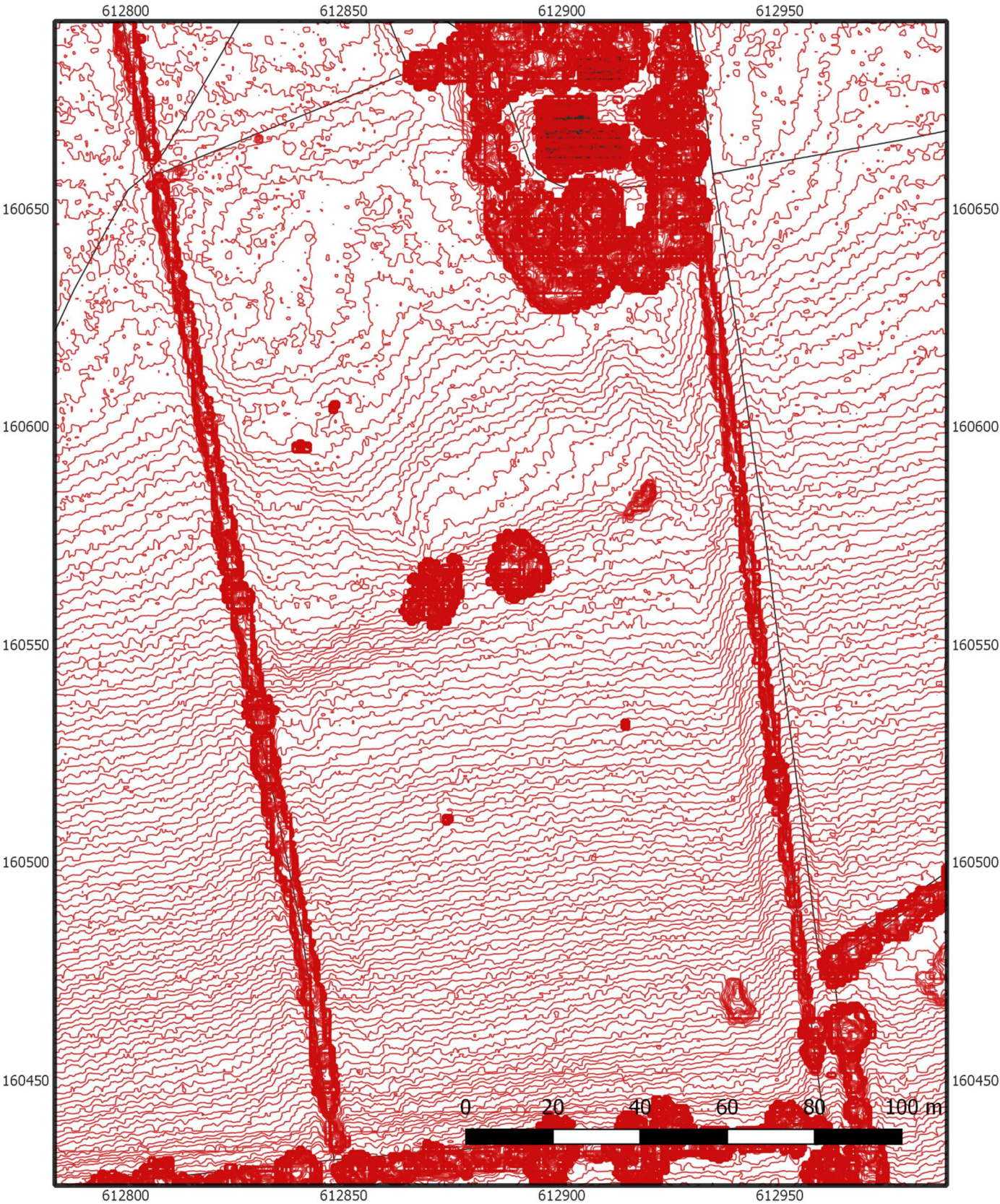


Fig. 55



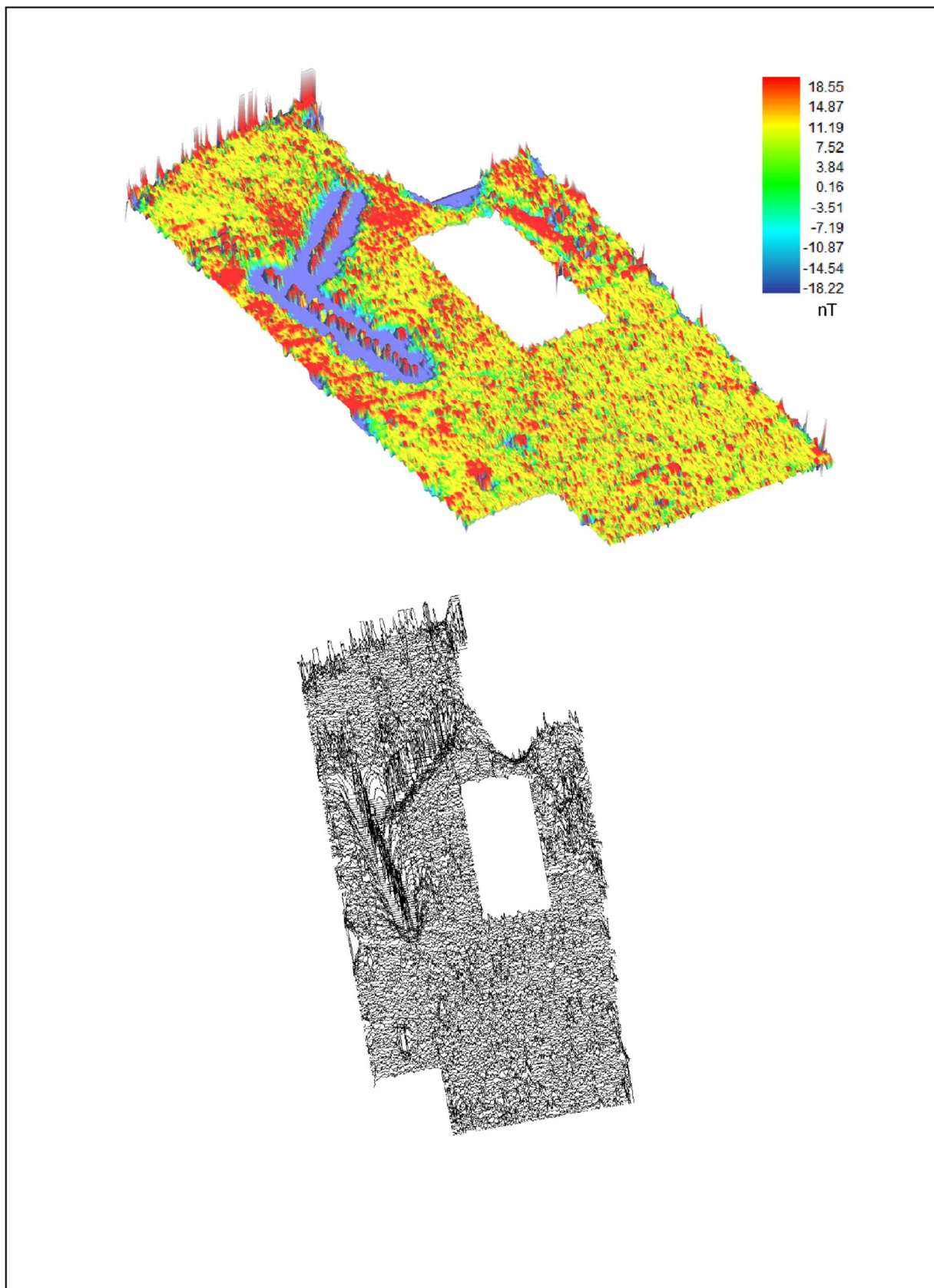


**Field 2 topographical model derived from 1m LiDAR data**

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**Fig. 56**





**Field 2 magnetometry survey results: 3d  
and colour relief and traceplot**

**Fig. 57**



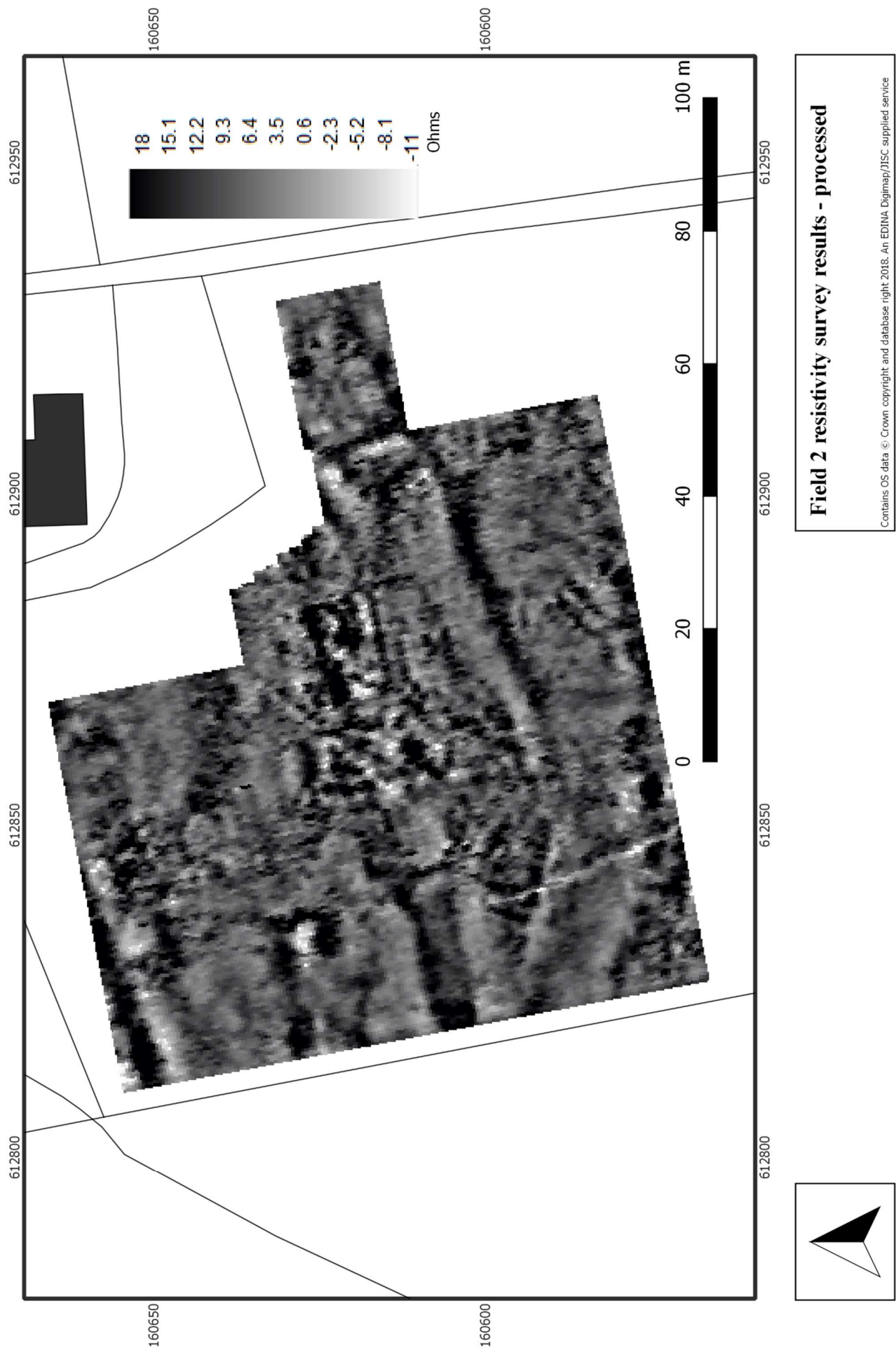


Fig. 58

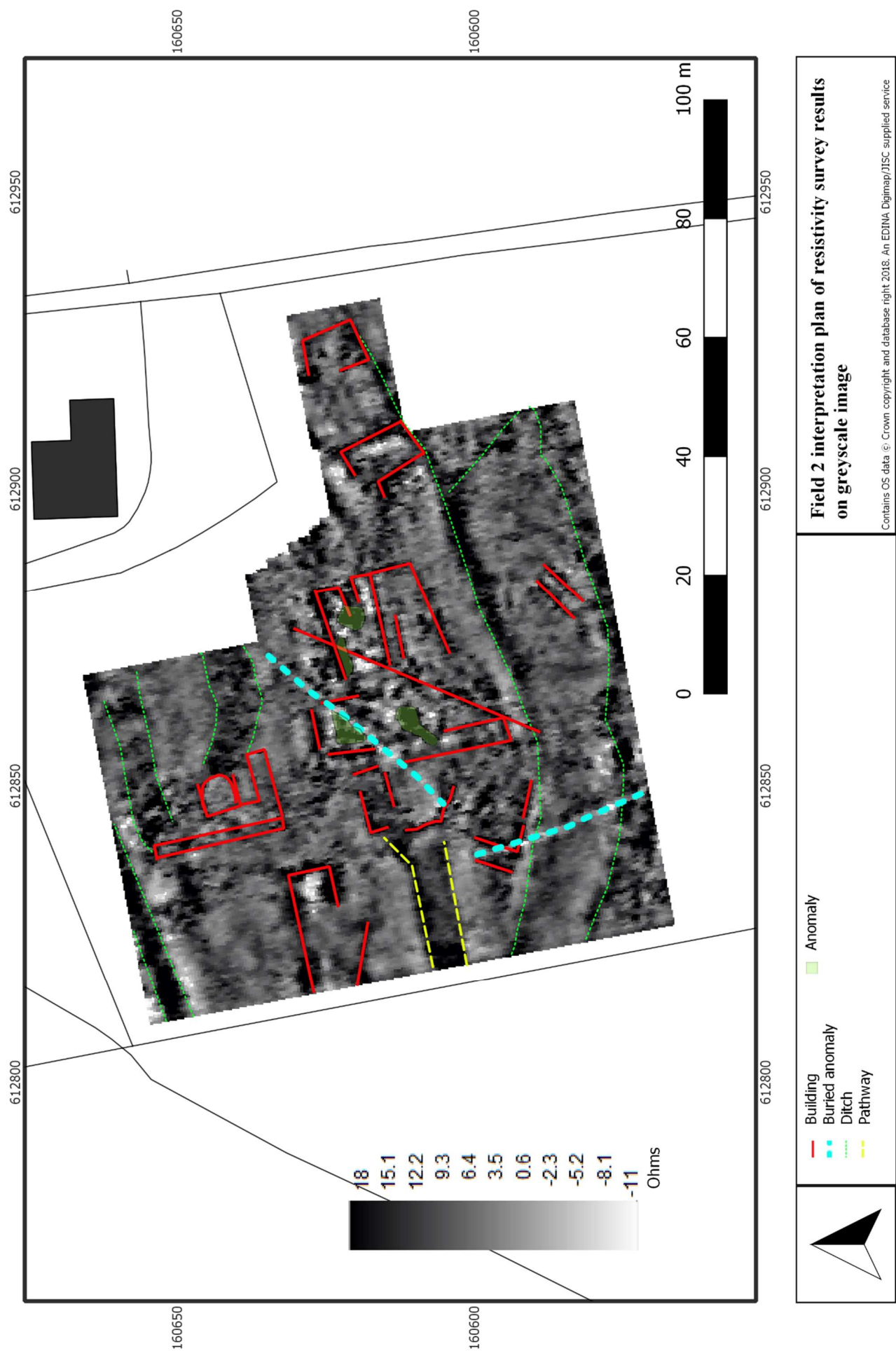


Fig. 59

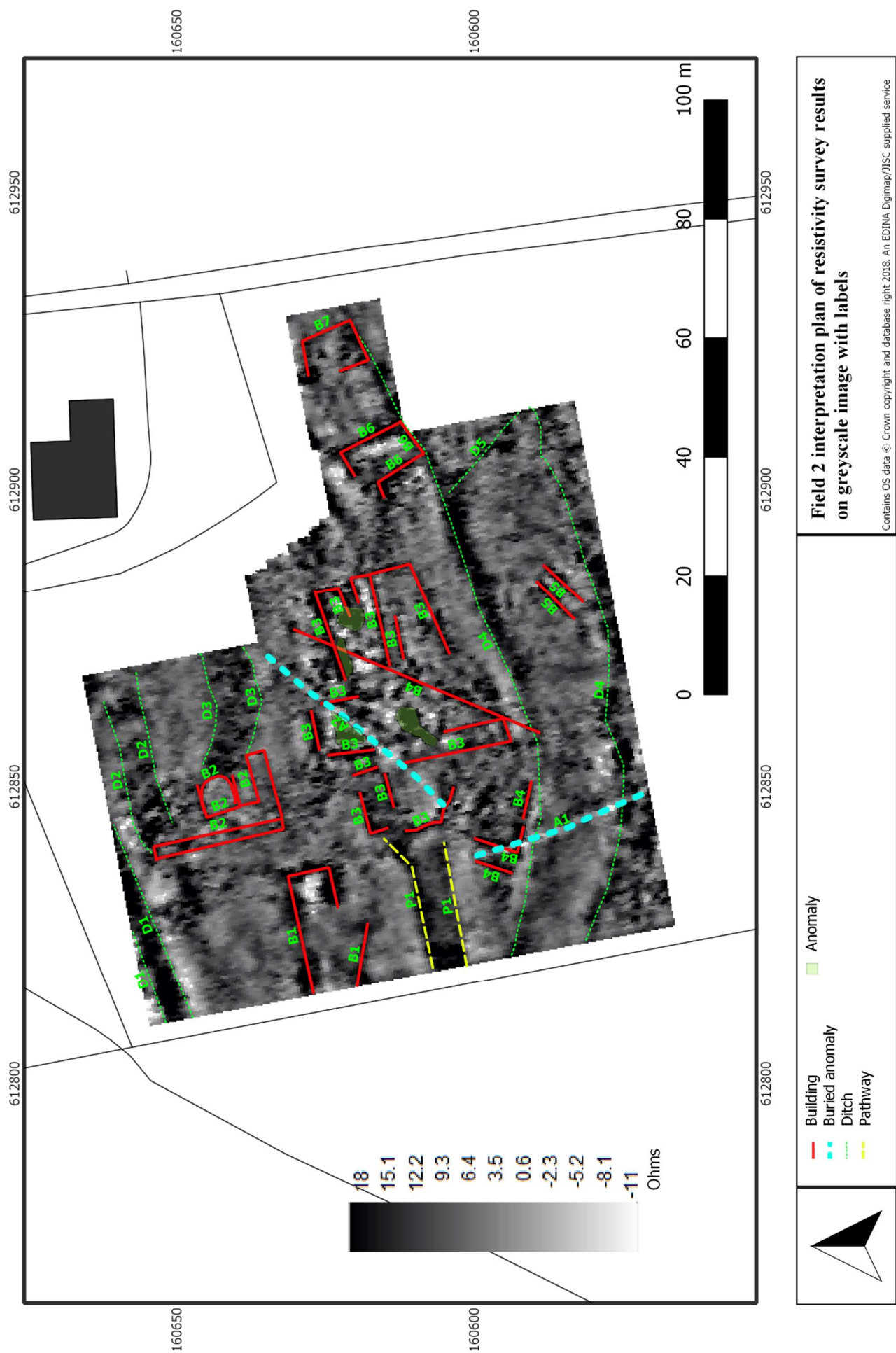


Fig. 60



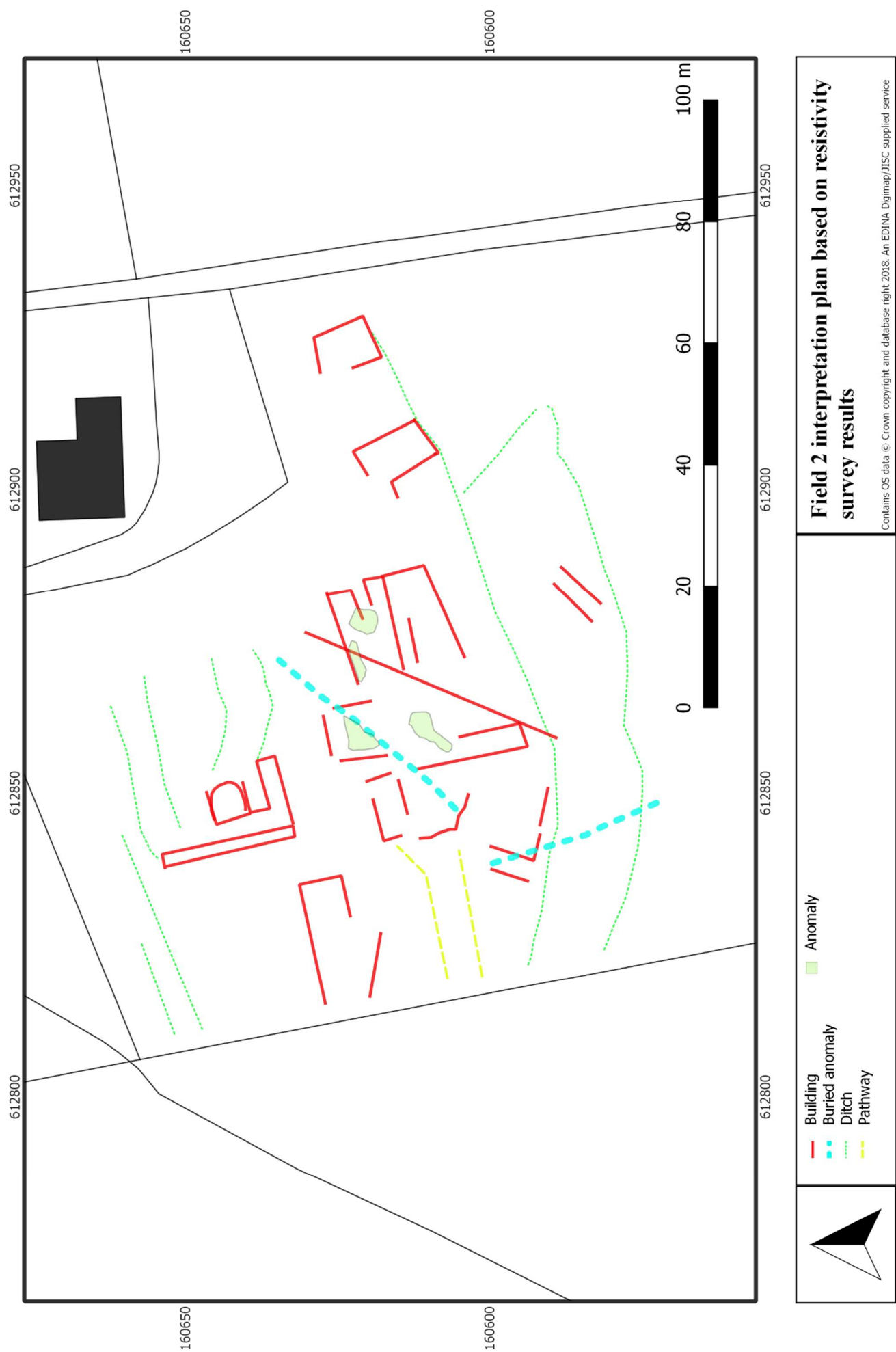


Fig. 61





Fig. 63





Fig. 64



Fig. 65

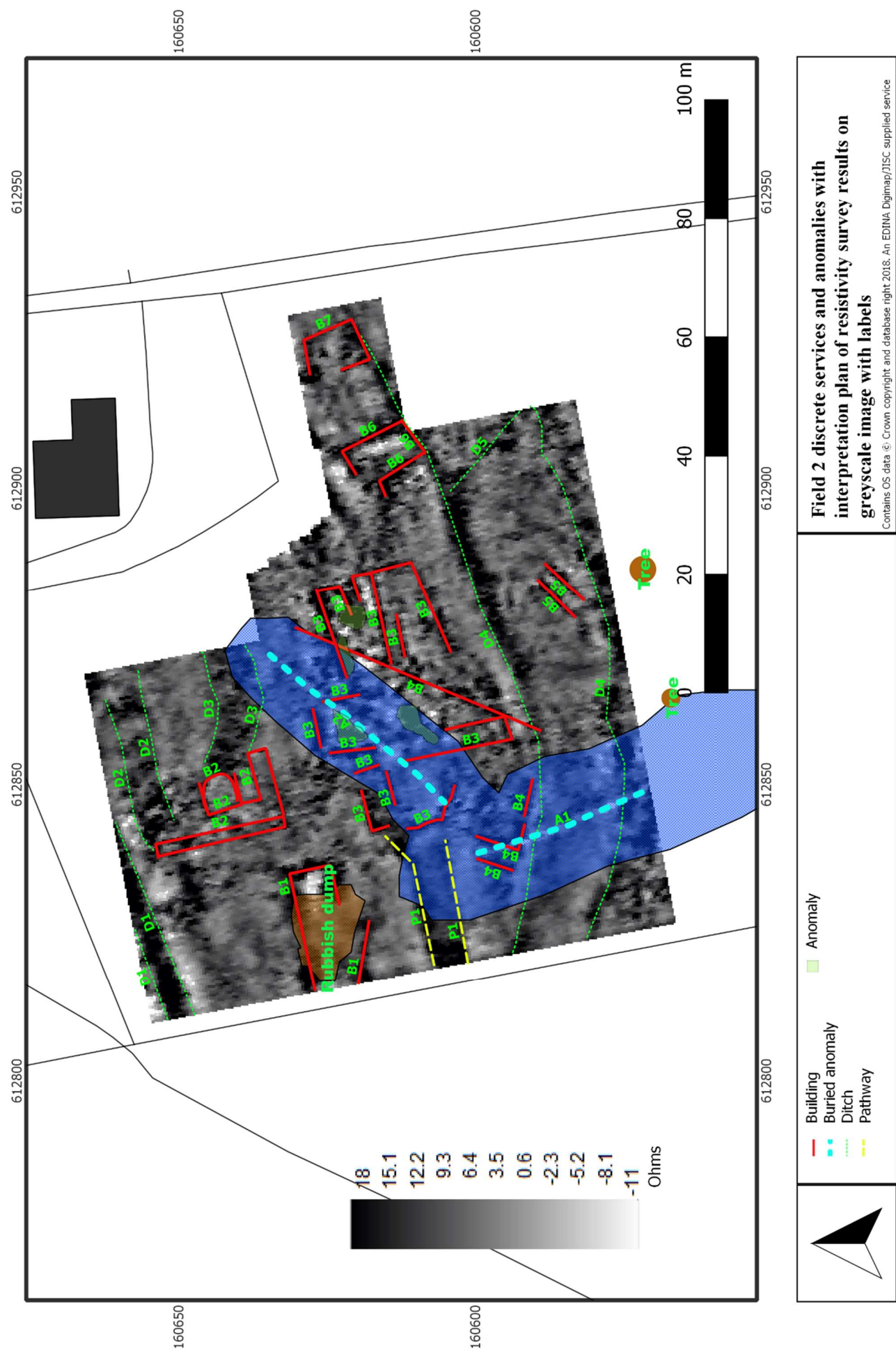


Fig. 66



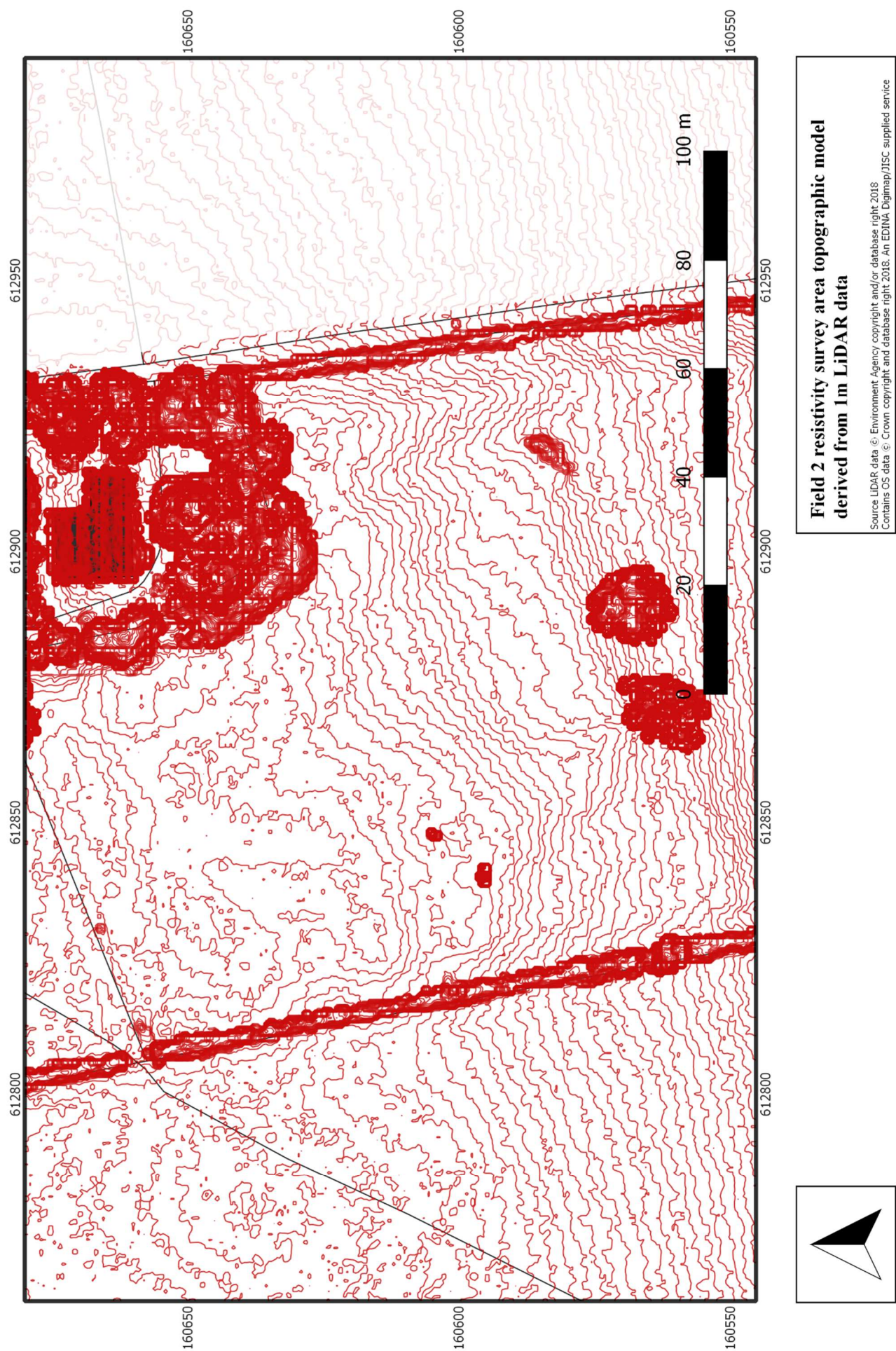
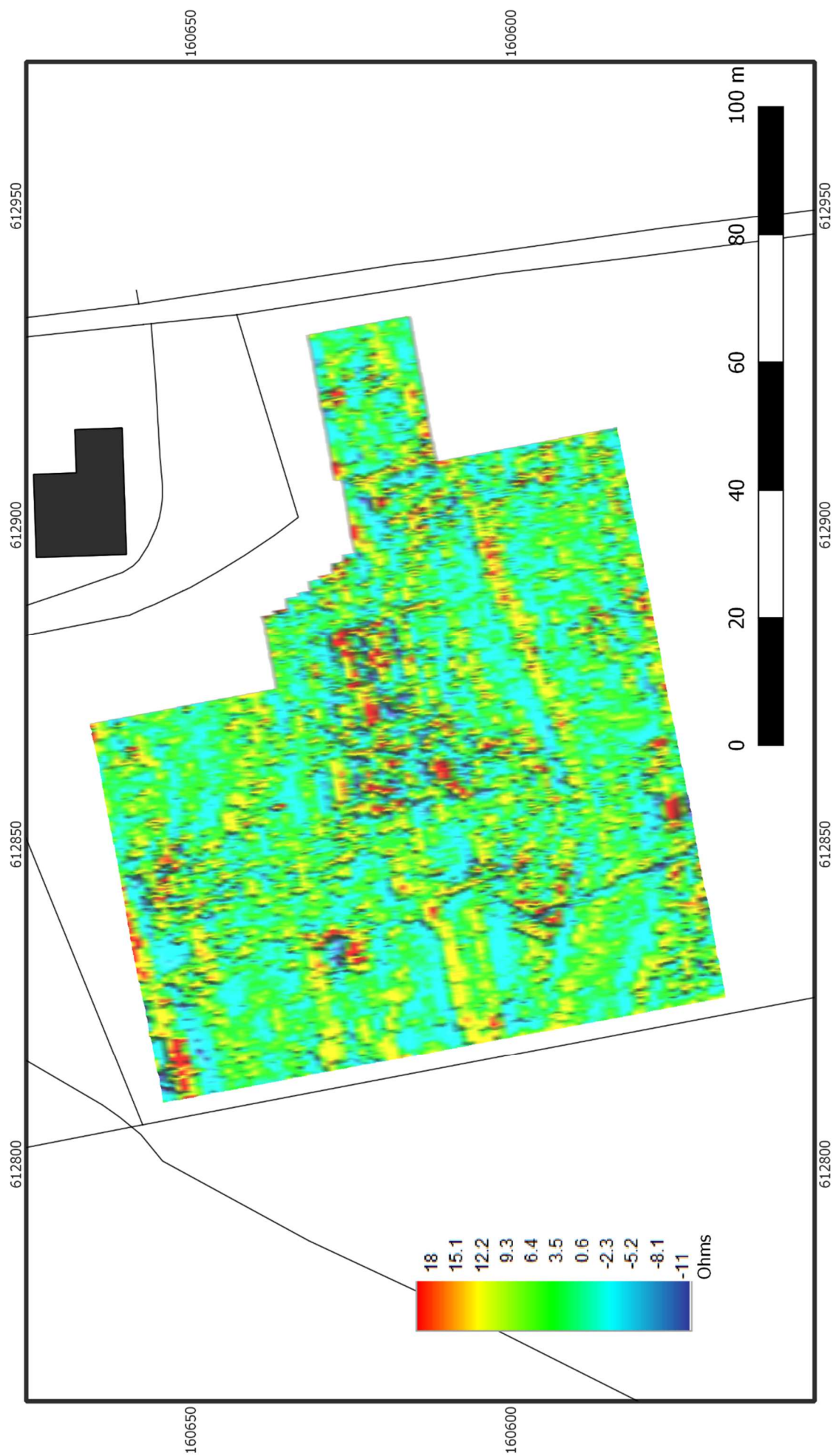


Fig. 67





**Field 2 resistivity survey results 3d and relief image**

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Fig. 68

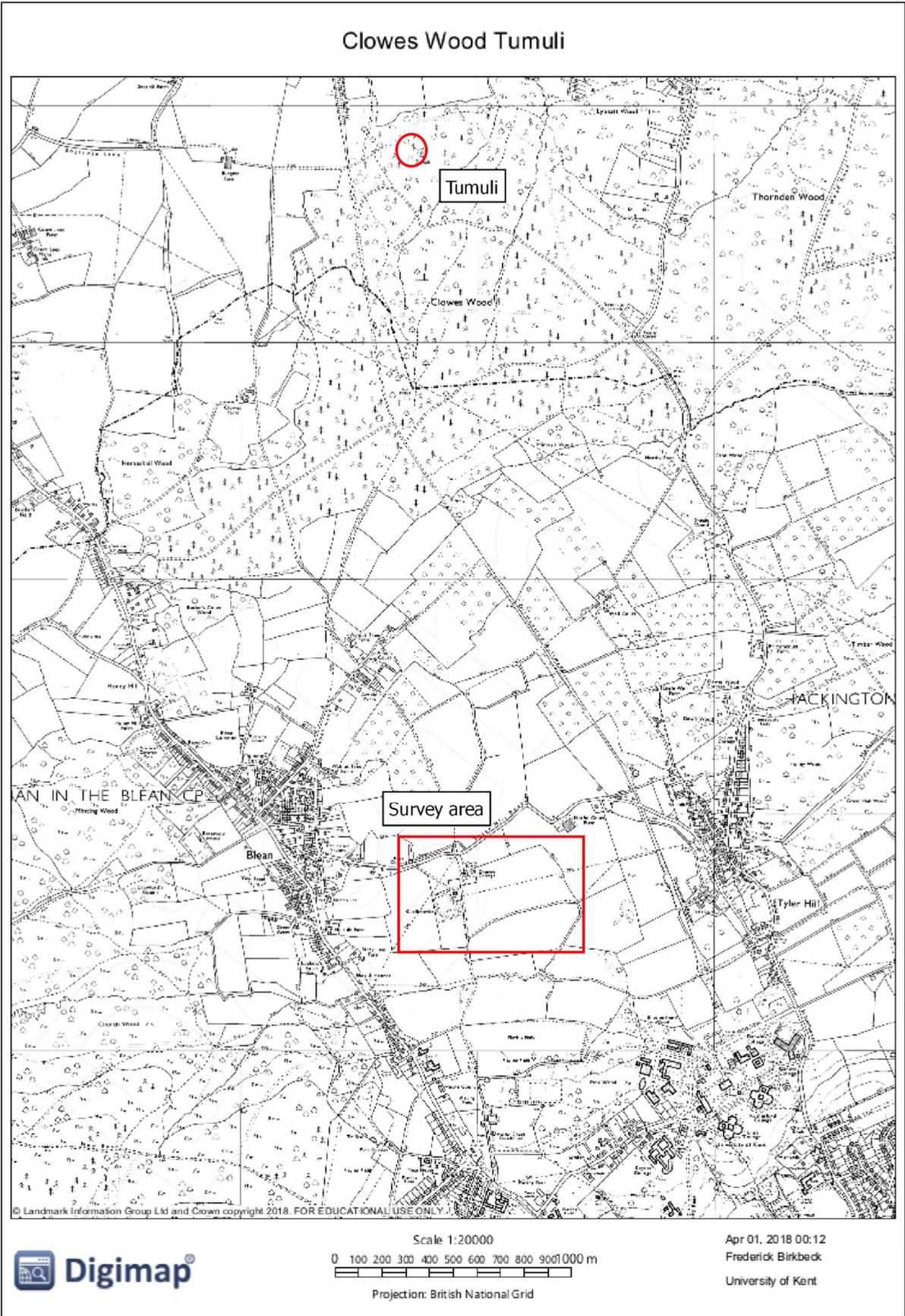


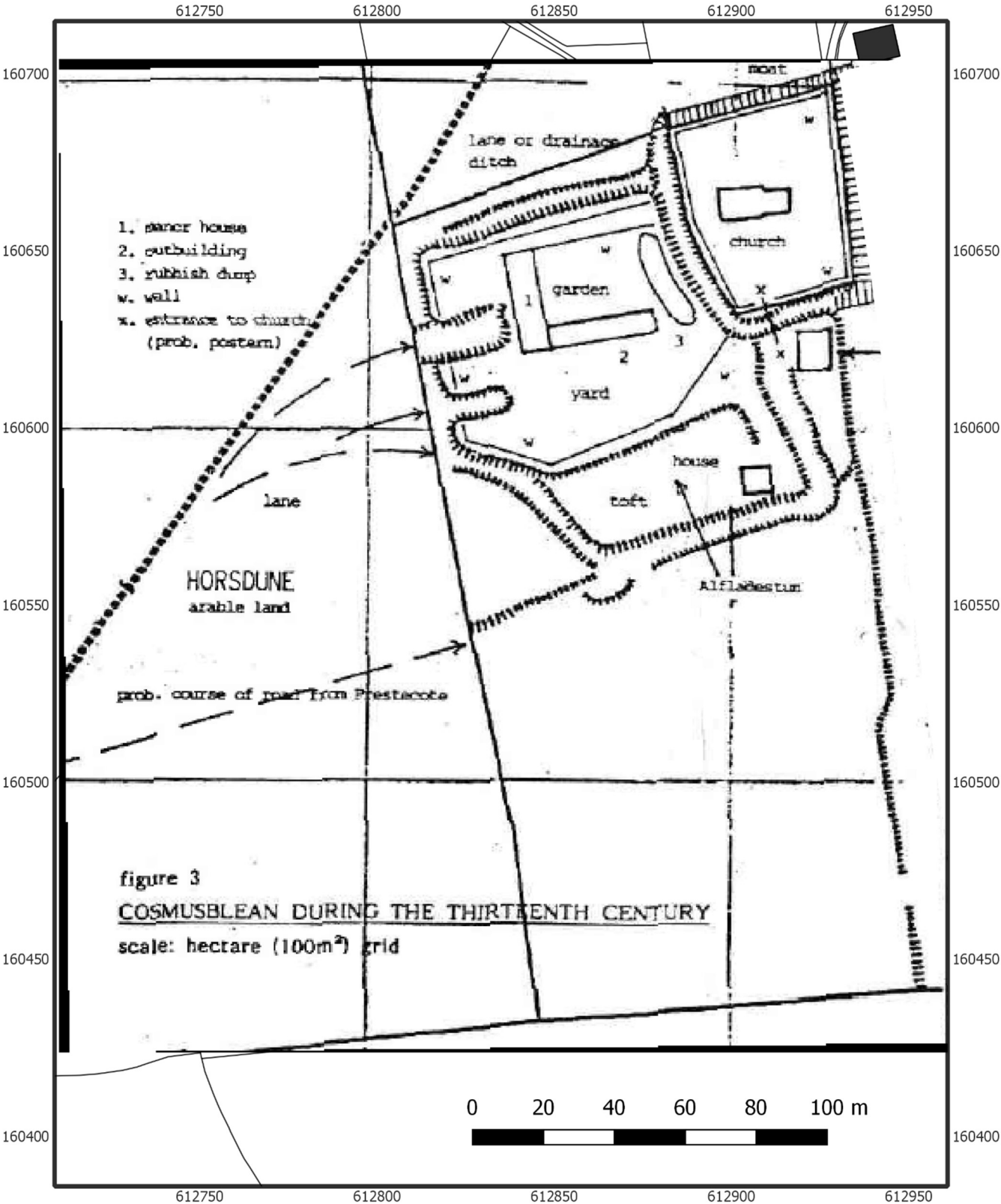
Fig. 69





**Fig. 70: Roman building material in the fabric of the church**





**Field 2: St. Clair-Terry's interpretation of the 13th century landscape**

Source after St. Clair-Terry (1986)  
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**Fig. 71**





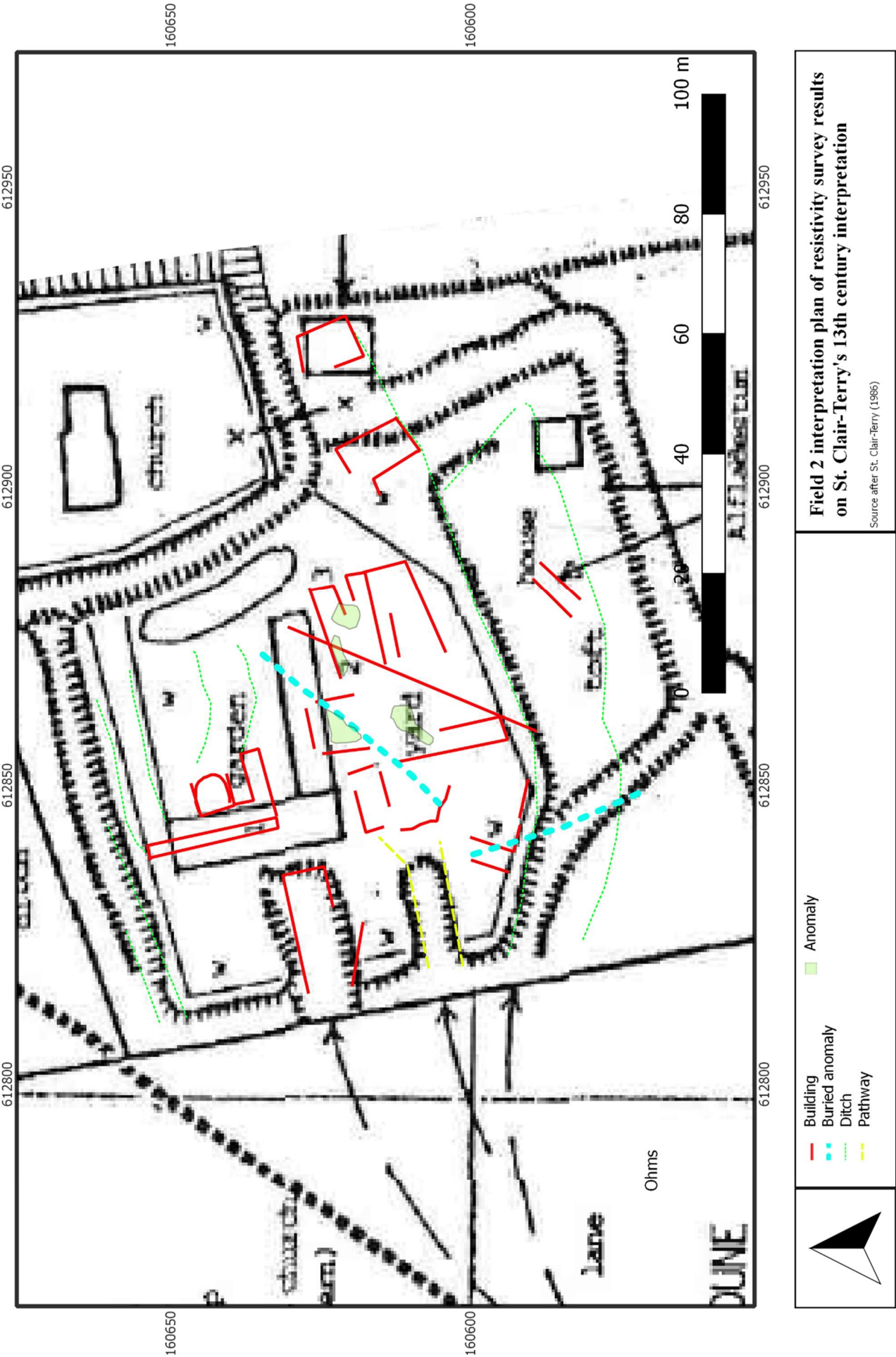
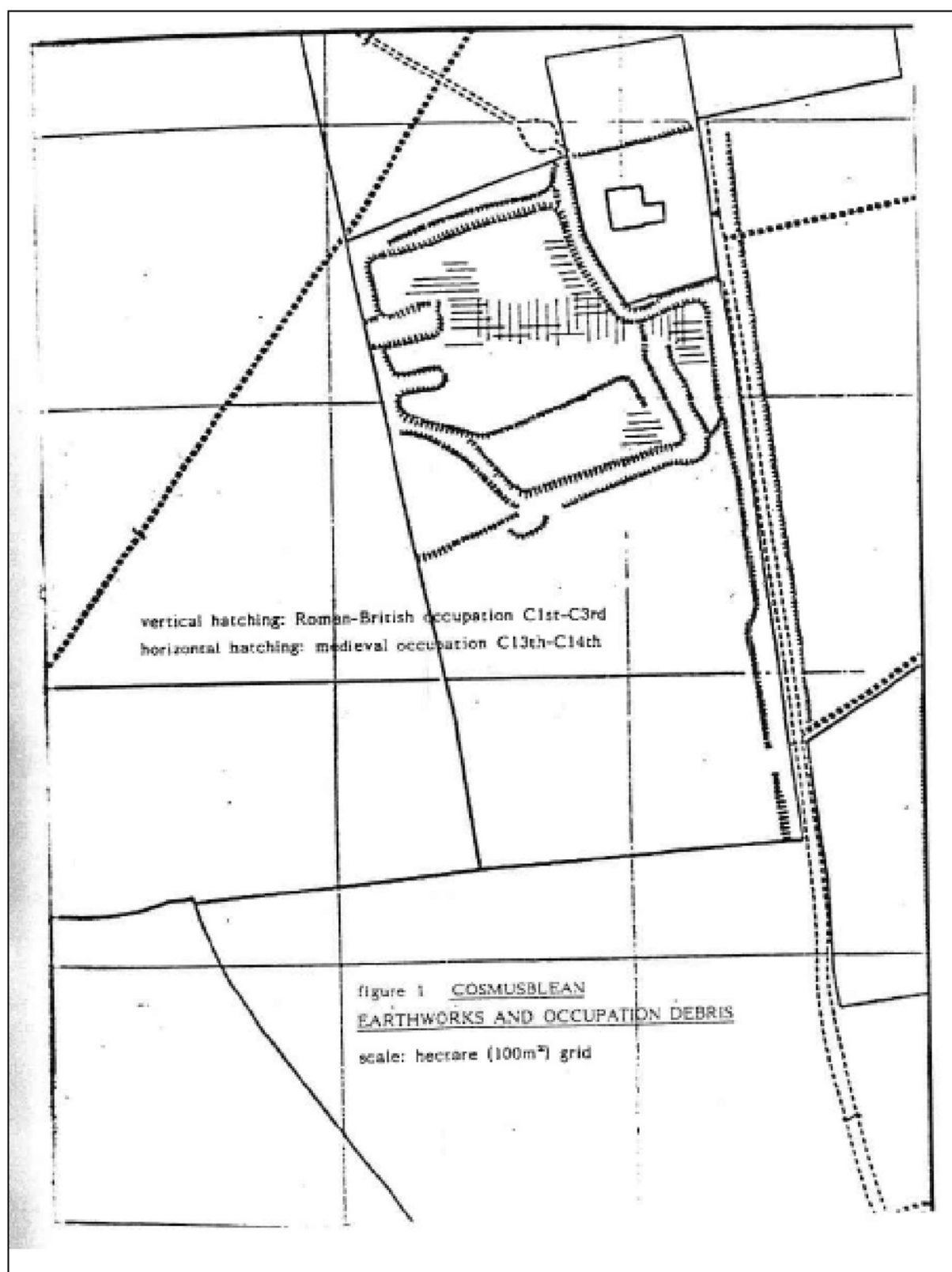


Fig. 72



**Fig. 73: Possible extension of [D1] north of the church**





Field 2 St. Clair-Terry finds distribution

Source: after St. Clair-Terry, 1986

**Fig. 74**





Fig. 75



Fig. 76





Fig. 77



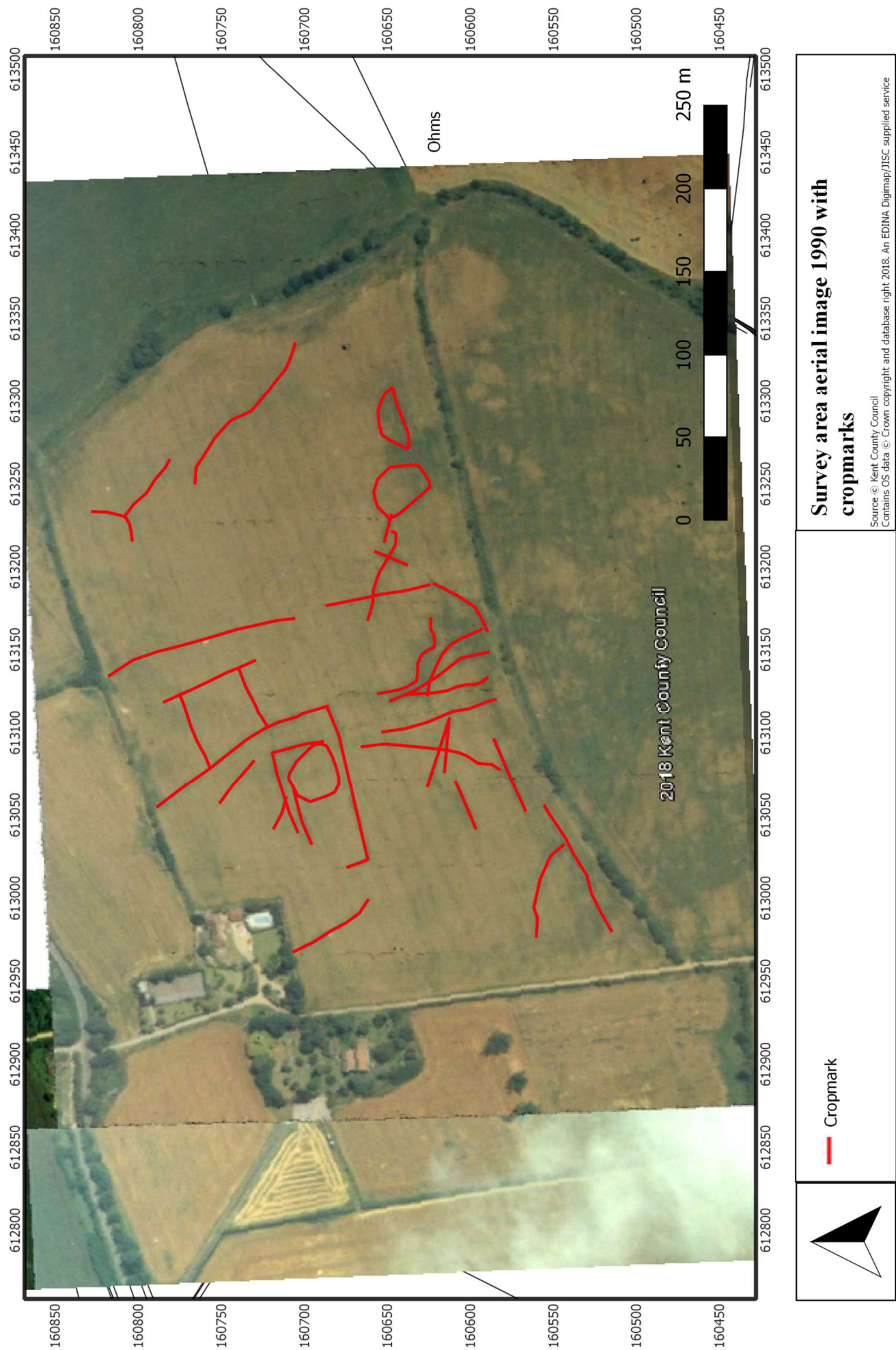


Fig. 78



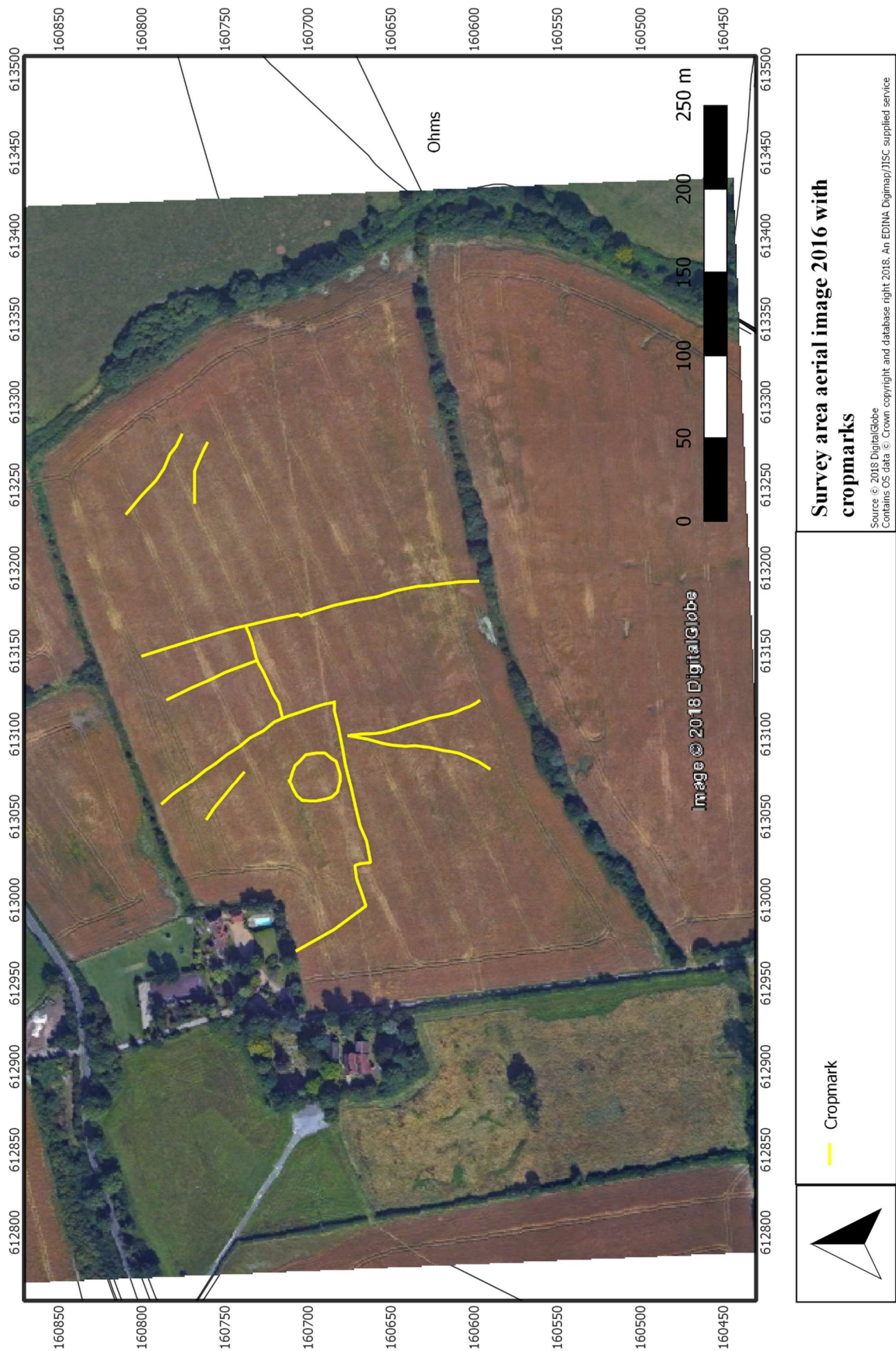


Fig. 79

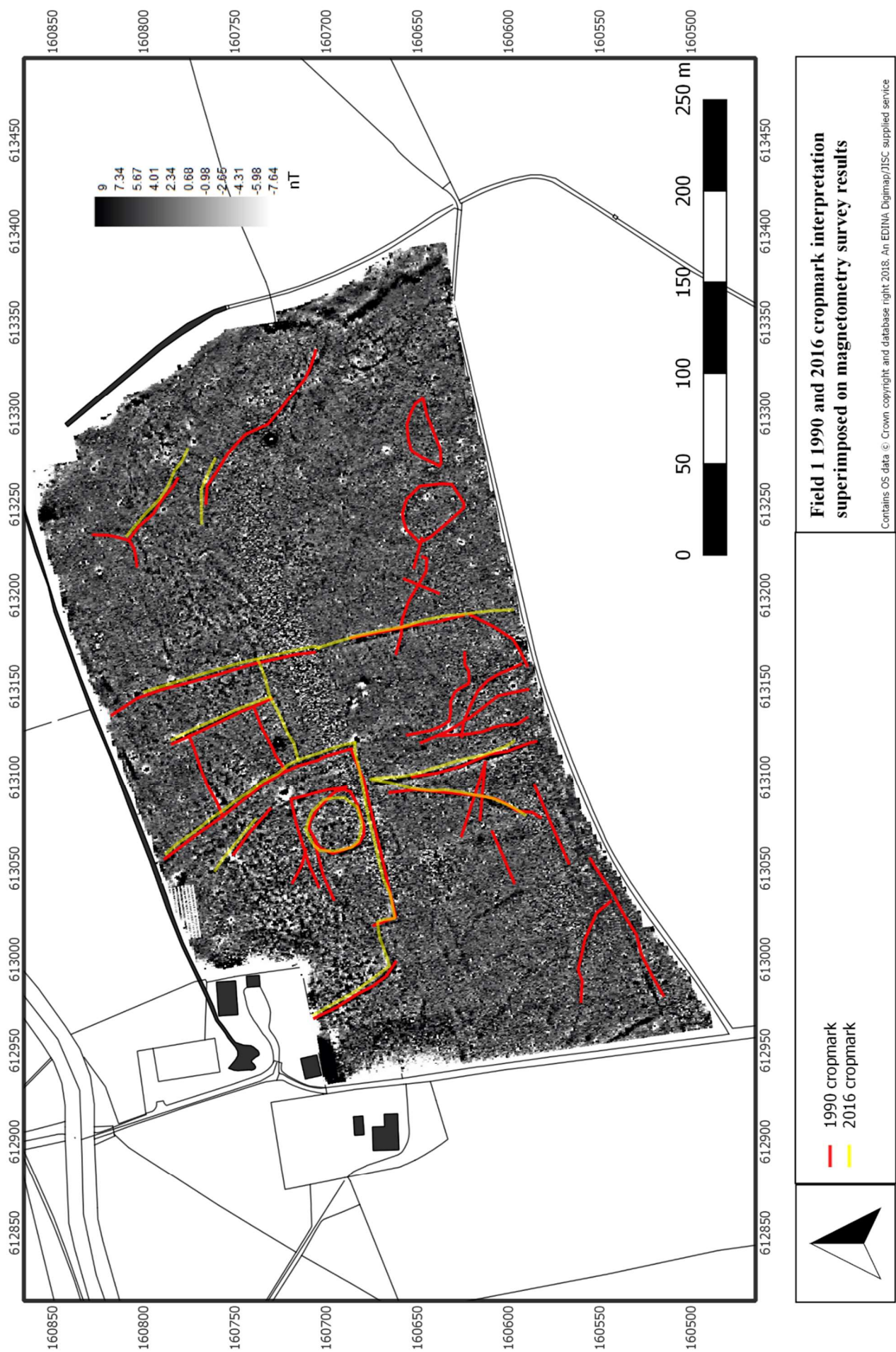


Fig. 80



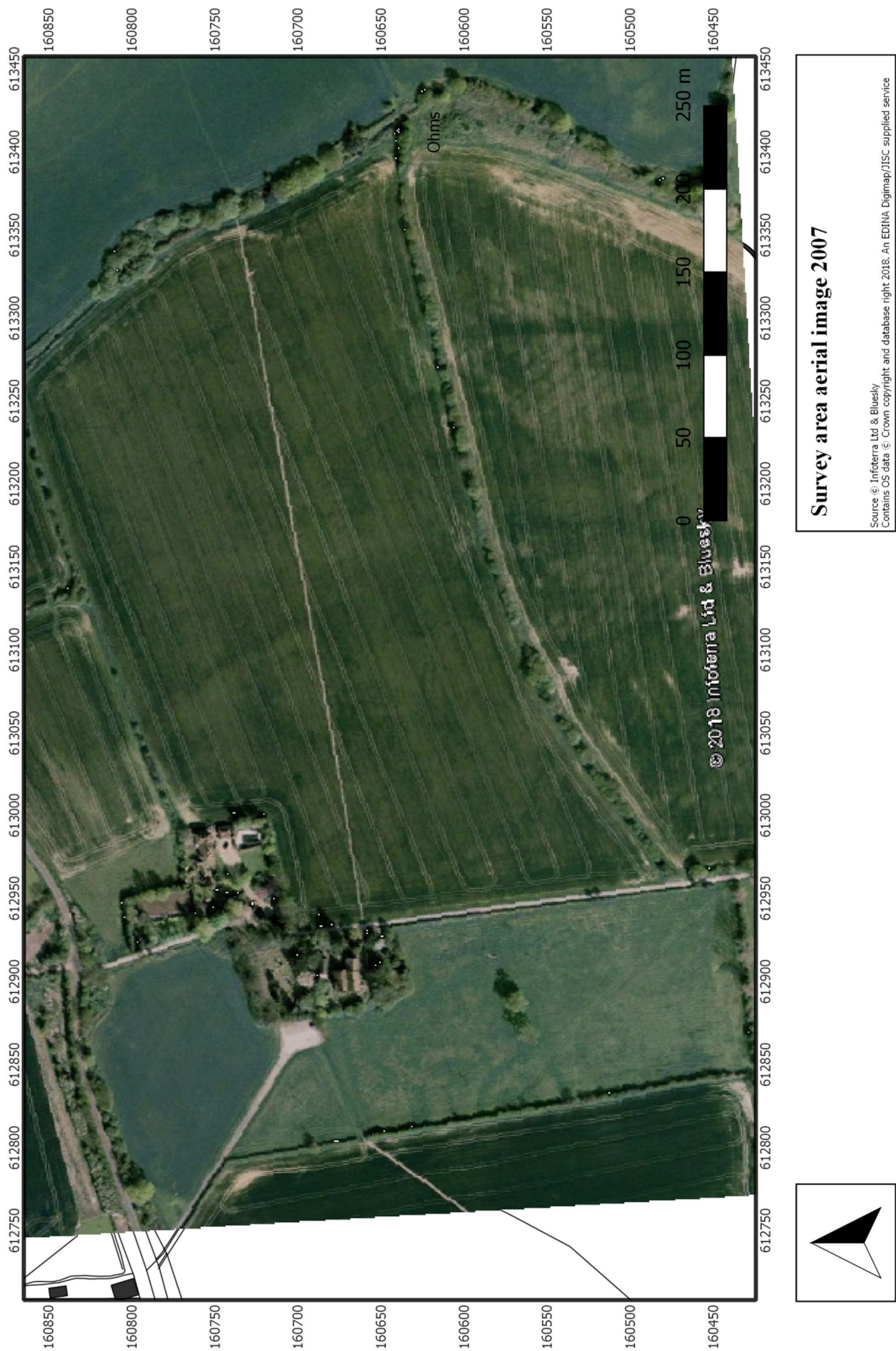
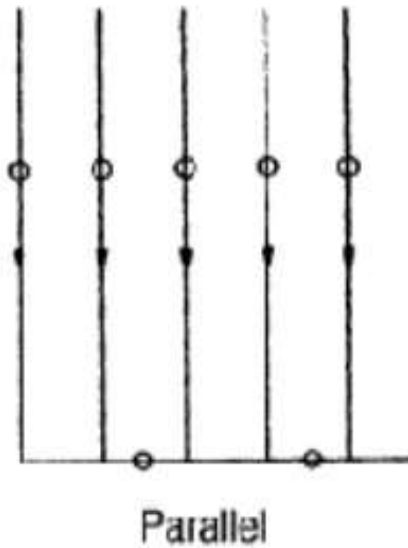
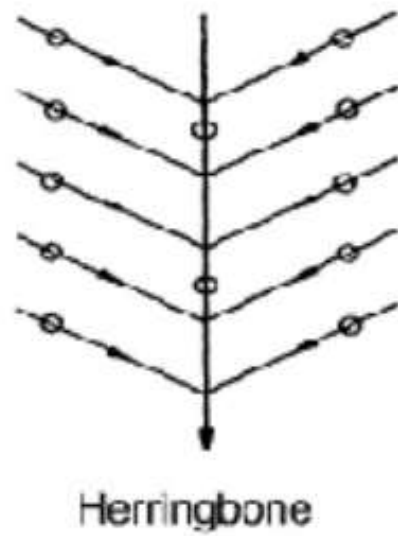


Fig. 81

**b) Parallel system.**



**c) Herringbone system.**



**Fig. 82: Field drainage systems (Namitha 2015)**



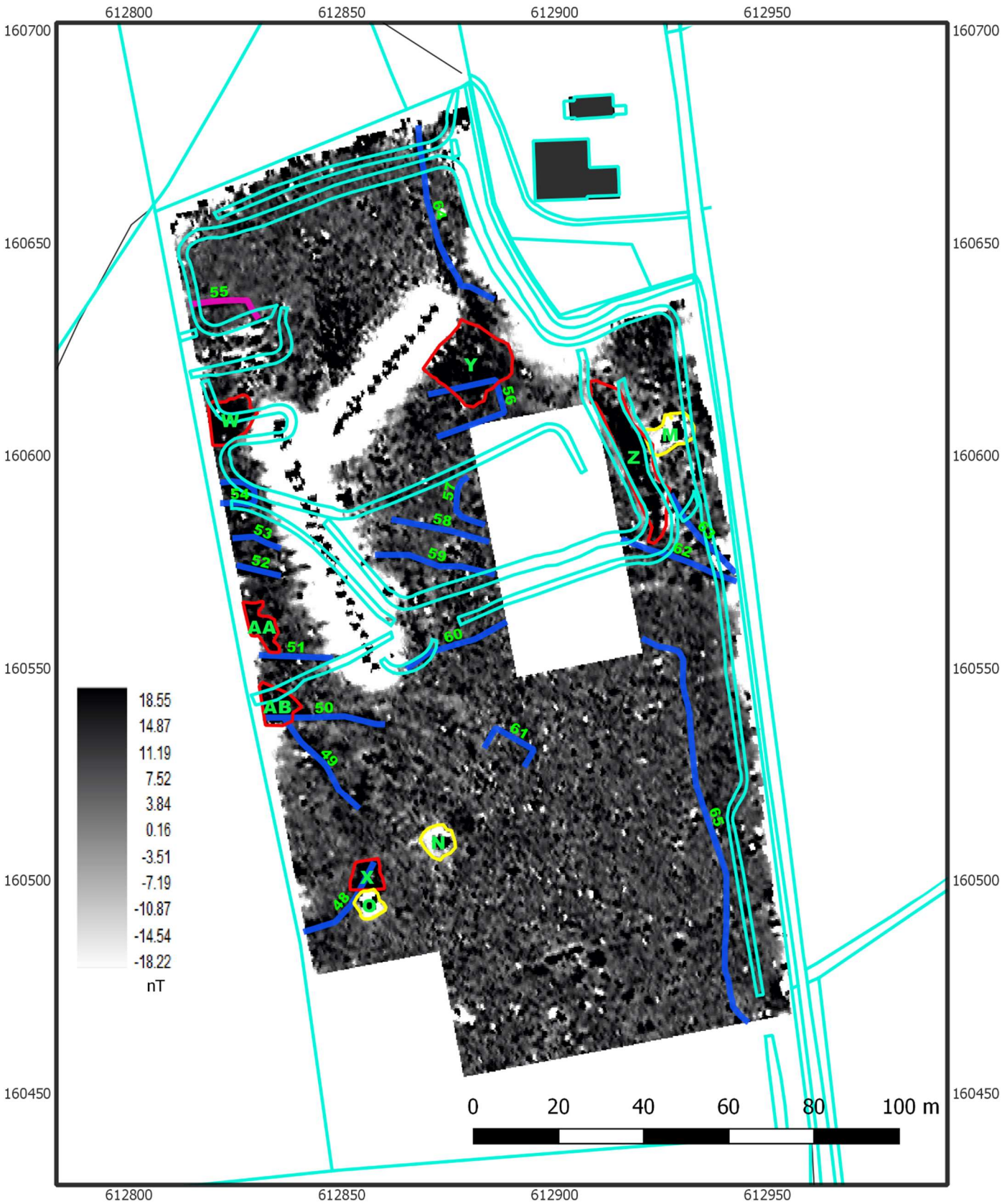


Fig. 83



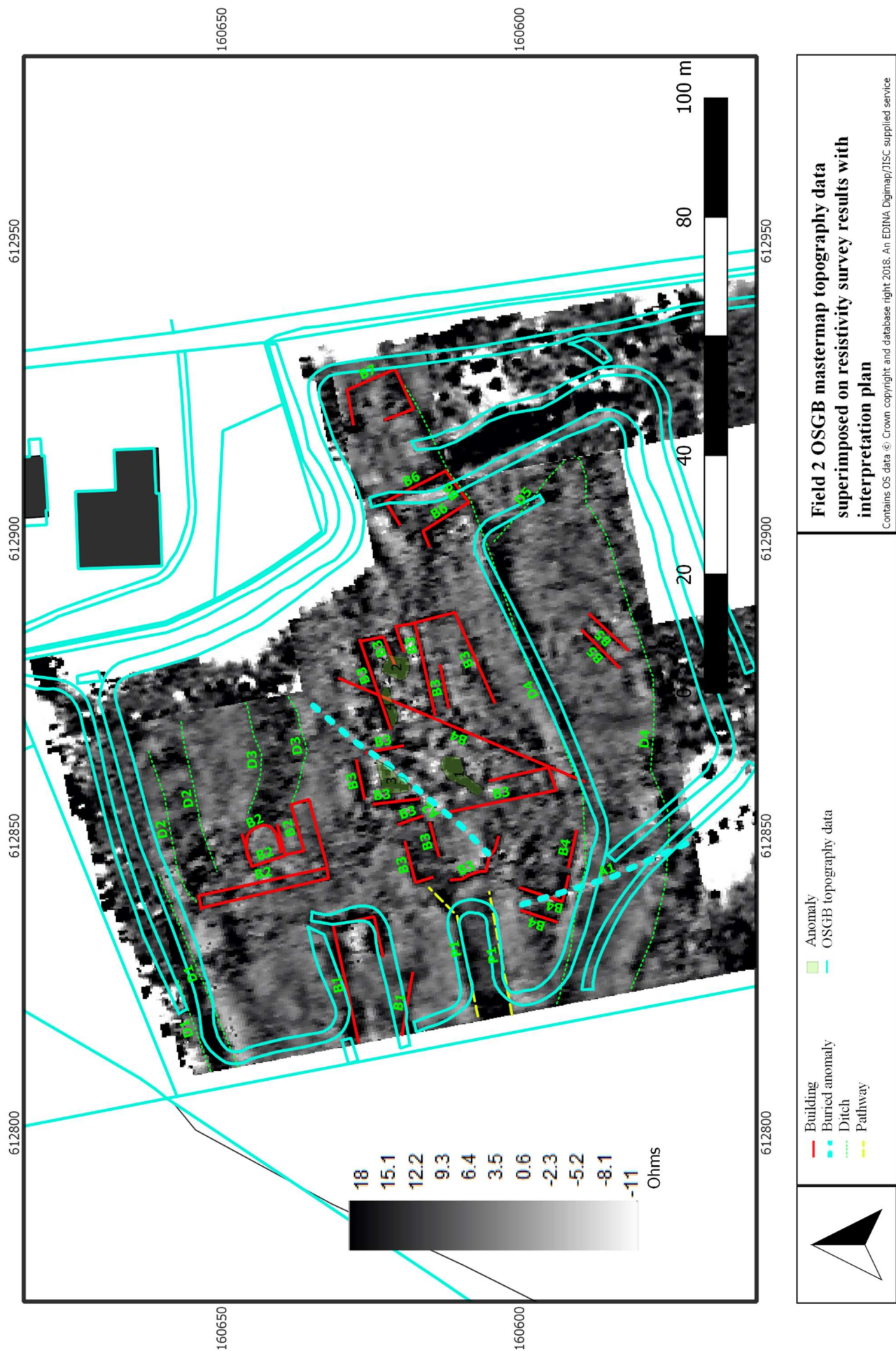


Fig. 84





**Fig. 85: Field 2 earthworks in west of field, north-south from north side of [D4]**



**Fig. 86: Field 2 earthworks, diagonal view NE – SW area between [B5] (left) and [B3] (right)**





**Fig. 87: Field 2 earthworks, north-south along eastern boundary (features [M] and [Z])**



**Fig. 88: Field 2 earthworks N-S view from the churchyard**



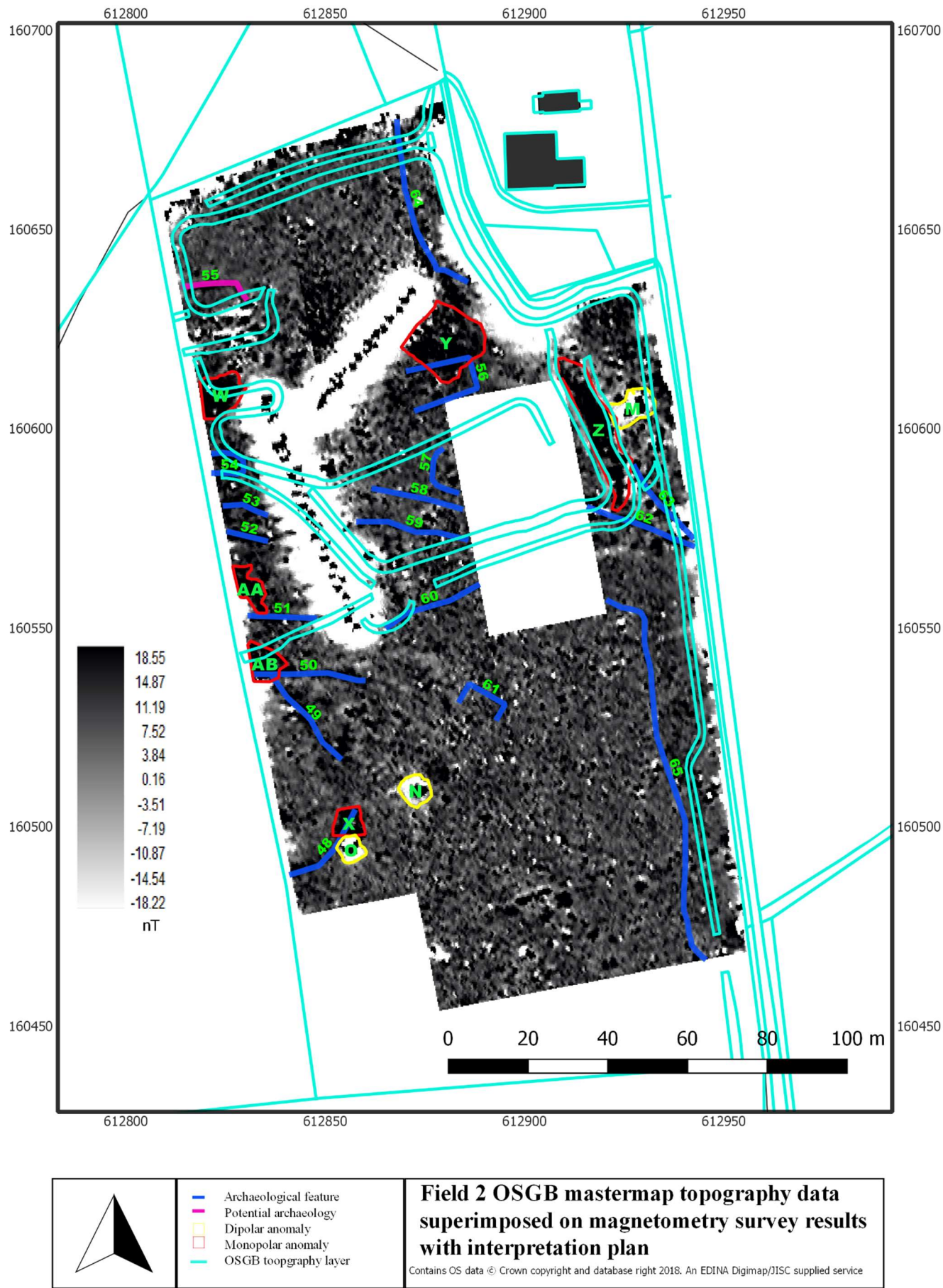


Fig. 89

**Field 2 OSGB mastermap topography data superimposed on resistivity survey results with interpretation plan**

Legend:

- Building
- Buried anomaly
- Ditch
- Pathway
- Anomaly
- OSGB topography data

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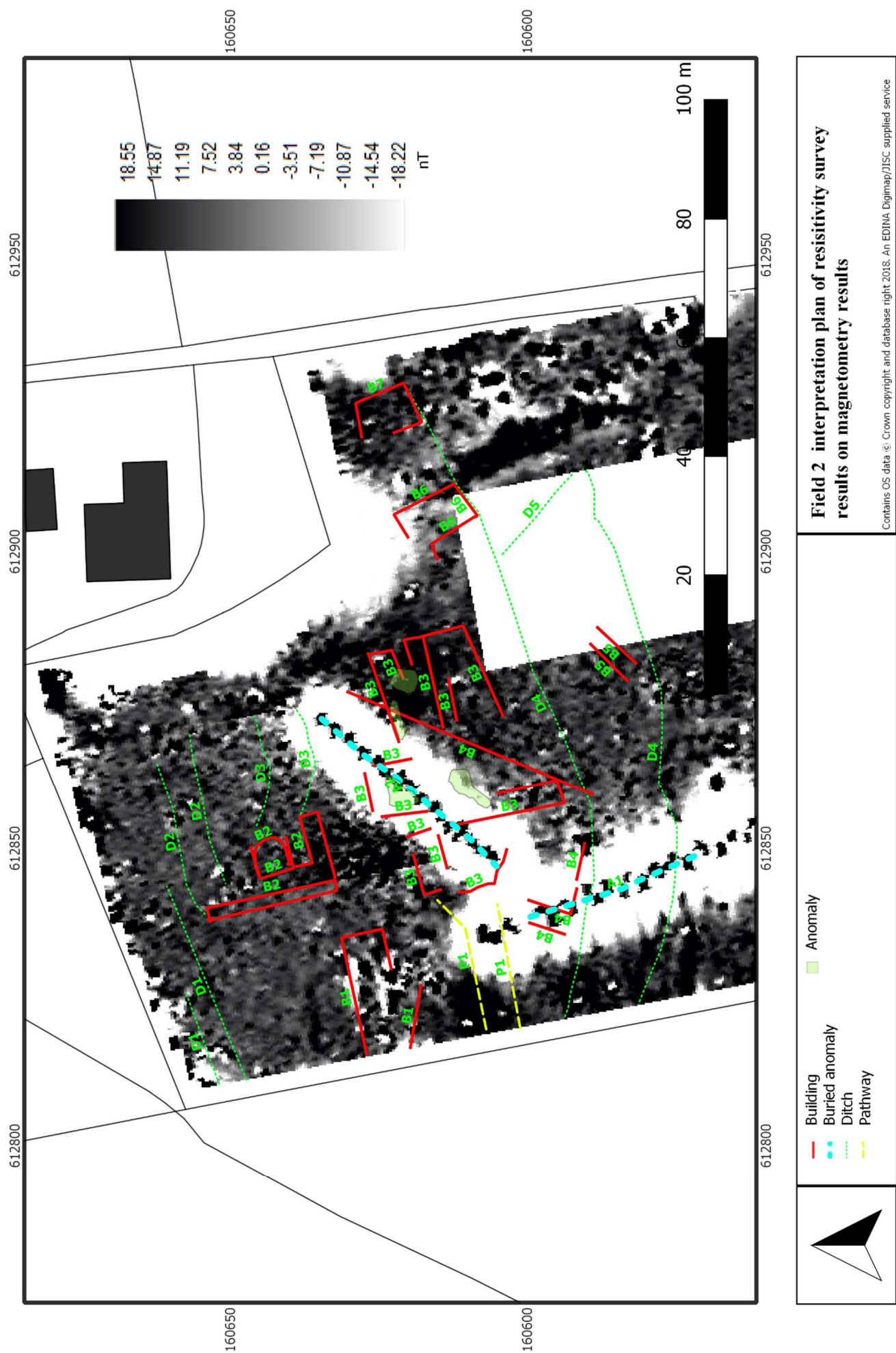


Fig. 91



## Field 2 interpretation plan of magnetometry survey results on resistivity survey results



**Fig. 93: Medieval Kent peg tile fragment found in 'platformed area' area A**



**Fig. 94: Modern ferrous metal fragment, one of many encountered in the south of Field 1**





**Fig. 95: Fragment of Roman imbrex found in the south of Field 1 (Source: Ade Cull)**



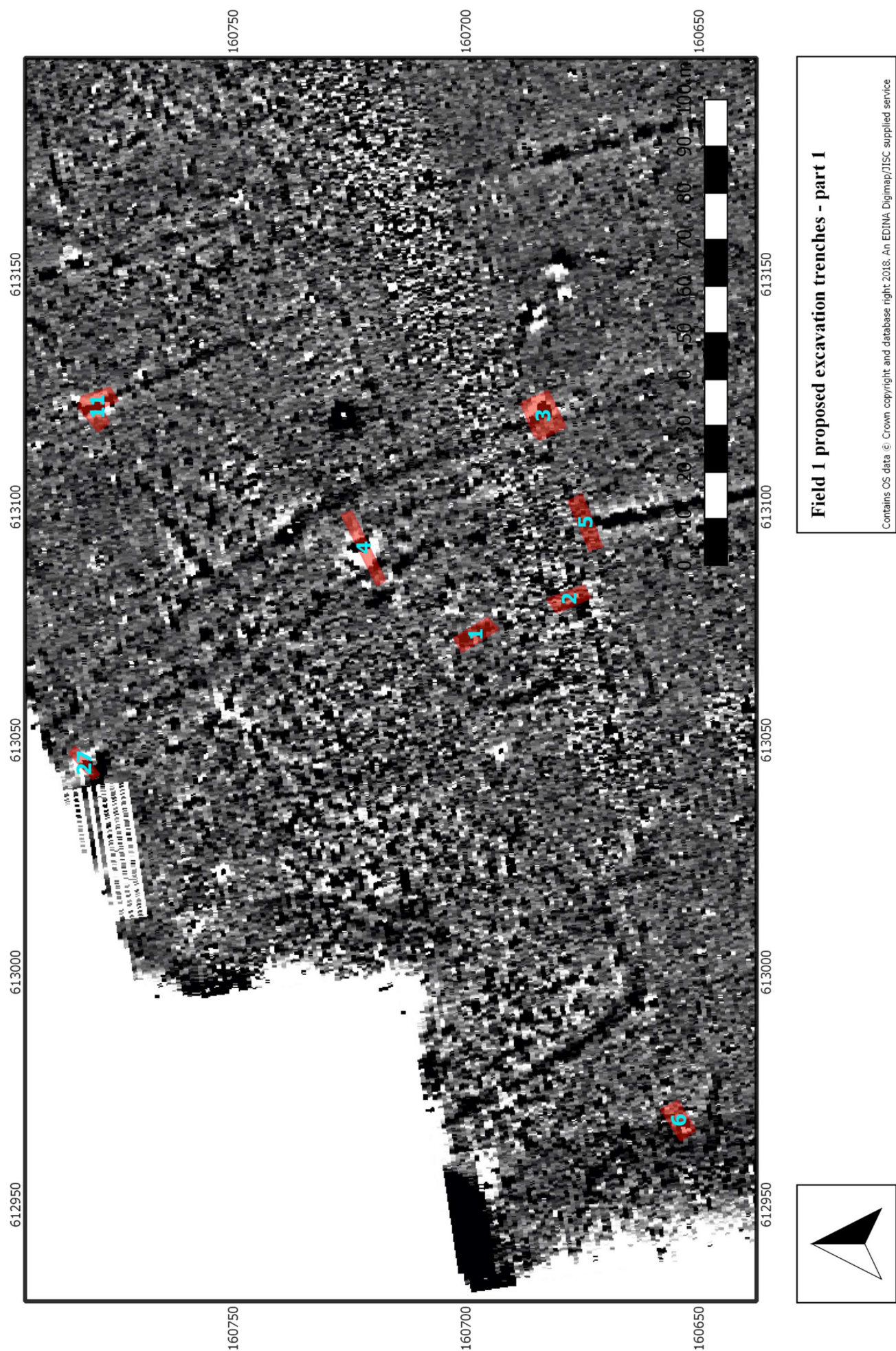


Fig. 96

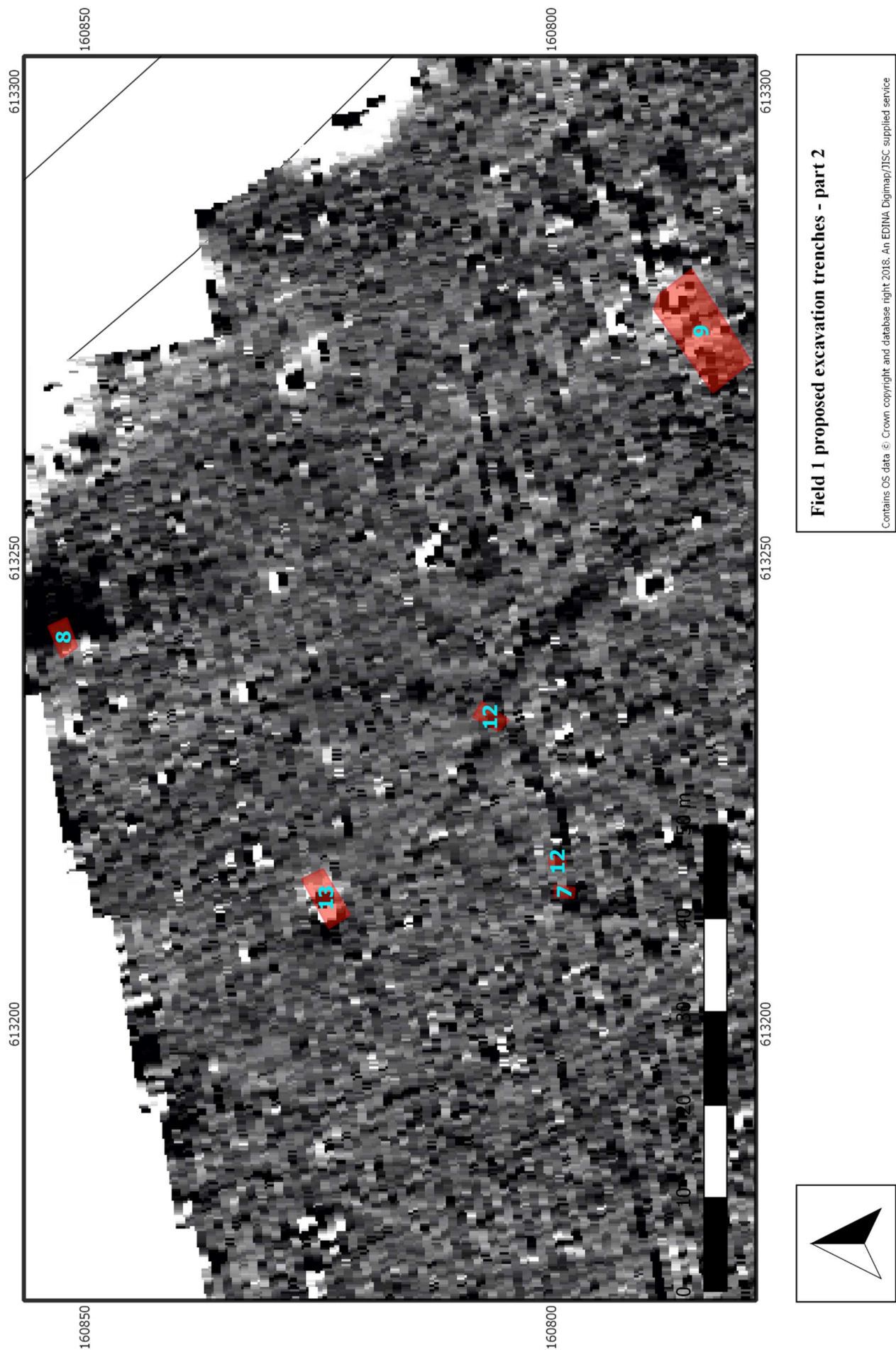


Fig. 97



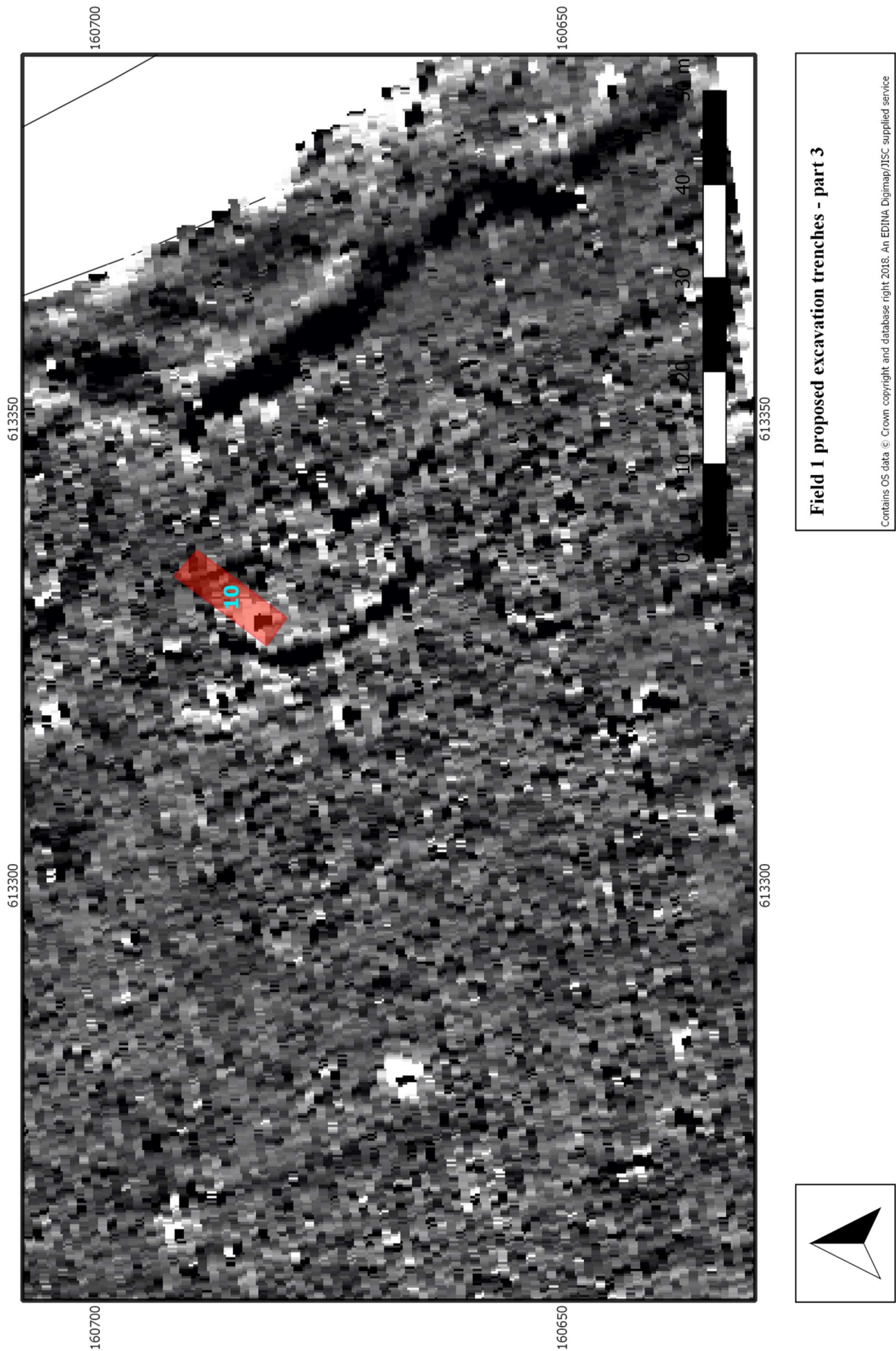


Fig. 98



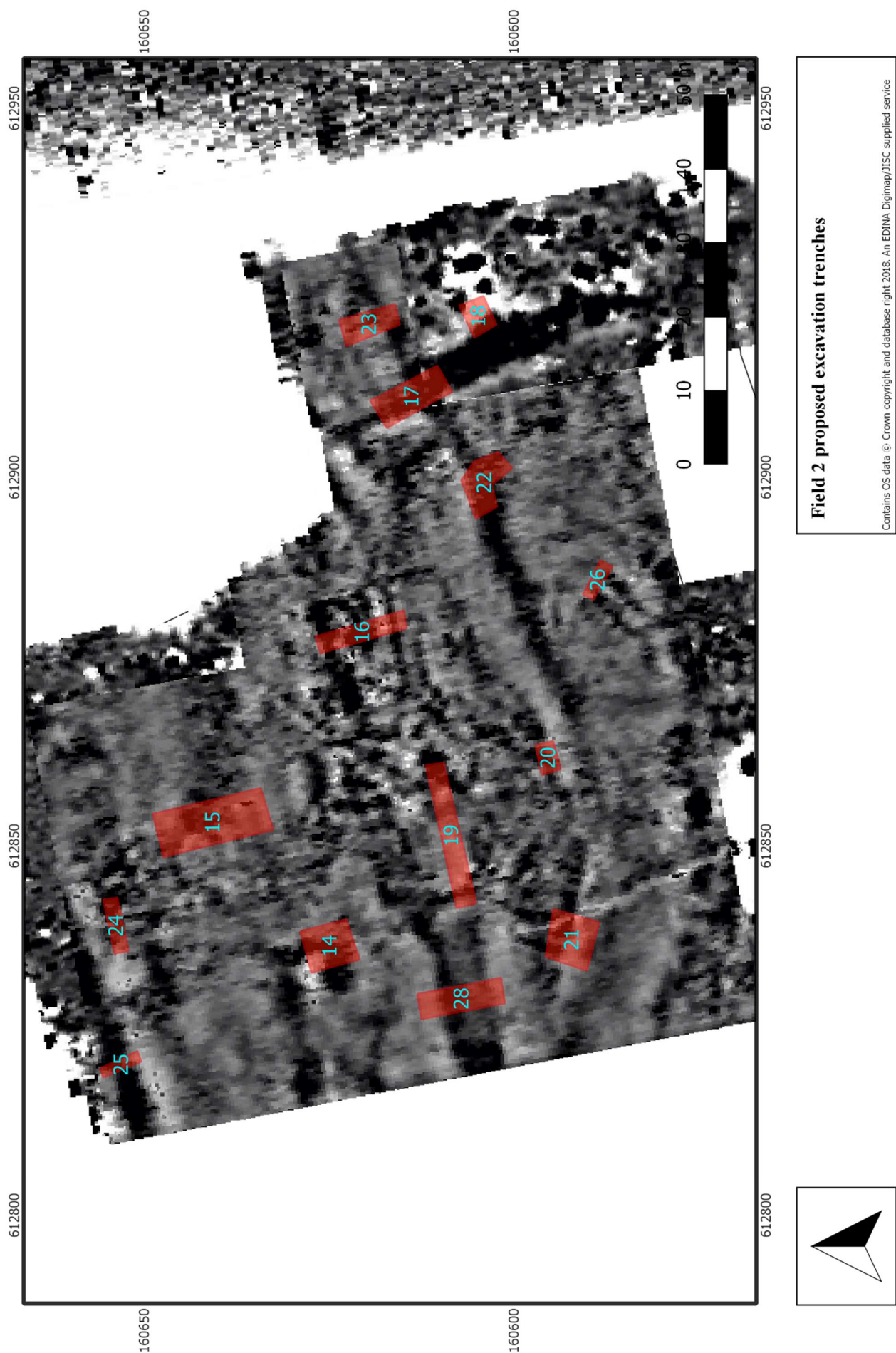


Fig. 99

## 11. Appendices

### 11.1. Section 42 licence.



Historic England

SOUTH EAST OFFICE

Mr Fred Birkbeck  
12 Ashdown Field  
Bolts Hill  
Chartham  
Kent  
CT4 7LQ

Direct Dial: 01483 252043

Our ref: AA/54105/5

27 November 2017

Dear Mr Birkbeck

**Ancient Monuments and Archaeological Areas Act 1979 (as amended) section 42 - licence to carry out a geophysical survey**

**DISPERSED MEDIEVAL SETTLEMENT REMAINS AND A ROMAN BUILDING IMMEDIATELY SOUTH WEST OF ST COSMUS AND ST DAMIAN'S CHURCH**

Case No:SL00175287

Monument no: 1018785

I refer to your application dated 14 November 2017, to carry out a geophysical survey at the above site.

Historic England is empowered to grant licences for such activity and I can confirm that we are prepared to do so as set out below.

By virtue of powers contained in section 42 of the 1979 Ancient Monuments and Archaeological Areas Act (as amended by the National Heritage Act 1983) Historic England hereby grants permission for geophysical survey of DISPERSED MEDIEVAL SETTLEMENT REMAINS AND A ROMAN BUILDING IMMEDIATELY SOUTH WEST OF ST COSMUS AND ST DAMIAN'S CHURCH, for the areas shown on the map that accompanied your application (copy attached). This permission is subject to the following conditions.

1. The permission shall only be exercised by Fred Birkbeck and Lloyd Bosworth and by no other person. It is not transferable to another individual.
2. The permission shall commence on 4 December 2017 and shall cease to have effect on 28 February 2018.
3. A full report summarising the results of the geophysical survey and their interpretation shall be sent in hard copy to Maria Buczak at the address below and electronic (pdf) format to [maria.buczak@HistoricEngland.org.uk](mailto:maria.buczak@HistoricEngland.org.uk), copied to [Paul.Linford@HistoricEngland.org.uk](mailto:Paul.Linford@HistoricEngland.org.uk) no later than 3 months after the completion of the survey.
4. The enclosed questionnaire shall be completed and appended to the survey



EASTGATE COURT 195-205 HIGH STREET GUILDFORD SURREY GU1 3EH

Telephone 01483 252020  
[HistoricEngland.org.uk](http://HistoricEngland.org.uk)



Historic England is subject to the Freedom of Information Act, 2000 (FOIA) and Environmental Information Regulations 2004 (EIR). All information held by the organisation will be accessible in response to an information request, unless one of the exemptions in the FOIA or EIR applies.



Historic England

SOUTH EAST OFFICE

report. For convenience an electronic version of this questionnaire can be downloaded from <http://HistoricEngland.org.uk/advice/technical-advice/archaeological-science/geophysics>.

5. A copy of the report shall also be sent (in their preferred format) to the local Historic Environment Record (HER). The local HER's contact details can be found at <http://www.heritagegateway.org.uk/gateway/chr/default.aspx>.
6. A record signposting your investigation shall be made with the Archaeology Data Service using their online OASIS Data Collection form no later than 3 months after completion of the survey. Please see <http://oasis.ac.uk/> for details or contact [oasis@HistoricEngland.org.uk](mailto:oasis@HistoricEngland.org.uk) for information and training.

This letter does not carry any consent or approval required under any enactment, bye-law, order or regulation other than section 42 of the 1979 Act (as amended).

You are advised that the person nominated under this licence to carry out the activity should keep a copy of this licence in their possession in case they should be challenged whilst on site.

Yours sincerely

**Maria Buczak**

Assistant Inspector of Ancient Monuments

E-mail: [maria.buczak@HistoricEngland.org.uk](mailto:maria.buczak@HistoricEngland.org.uk)



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## **11.2. Risk Assessments**

## RISK ASSESSMENT FORM

(BASED ON HSE "FIVE STEPS TO RISK ASSESSMENT")

Sheet No :.....1.....

Department/Section ...Classical and Archaeological Studies

Work Area ...Blean church east.....

Date of Assessment .....10/09/2017.....

Assessor .....Fred Birkbeck.....

Signature .....

Date of Review .....

HAZARD (List)	PERSONS AT RISK AND HOW (Consider all persons, including those who may not be involved with the job)	EXISTING CONTROL MEASURES AND ADEQUACY (List the control measures appropriate to each hazard and consider the level of residual risk; is it high, medium or low?) If using a risk matrix then show risk factor (RF) = (hazard x risk)	ADDITIONAL REQUIREMENTS (If the residual risk is high, you must take additional practicable measures to reduce it, or abort the proposed task)
ENVIRONMENTAL  Wet weather	All participants  Risk = Illness	Encourage participants to wear waterproof clothing and bring dry clothes to change into.	

<b>Lightning Strike</b>	<b>All participants</b> <b>Risk = personal injury</b>	<b>RF = low</b>  <b>Vacate site if lightning storm thought to be imminent</b>  <b>RF = very low</b>	
<b>Hot weather</b>	<b>All participants</b> <b>Exposed field with very little shade</b> <b>Risk = illness/ personal injury</b>	<b>Encourage participants to wear sunscreen and light clothing that covers the whole body, hats should be worn. Take regular breaks and use shady areas in churchyard when possible</b>  <b>Risk = medium</b>	
<b>SITE SPECIFIC</b>		<b>Wear footwear with appropriate grip</b>  <b>RF = low</b>	
<b>Steep slope</b>	<b>All participants</b>		



	<p>Steep slope in south-west of field</p> <p>Risk = personal injury</p>	<p>Avoid contact with dogs</p> <p>RF = low</p>	
Animals and livestock	<p>All participants</p> <p>No livestock present on site, occasional dog walkers</p> <p>Snakes</p> <p>Risk = Personal injury</p>	<p>Take care around the car park and public path, be vigilant when entering and exiting site for cyclists and particularly farm machinery</p>	
Moving vehicles	<p>All participants</p> <p>Car park area is open to the public reversing and driving into parking spaces</p> <p>Possible farm machinery in operation on adjacent fields,</p> <p>Cyclists on public path along the west of the site</p> <p>Drivers may be unsighted, low risk of collision due to low speeds</p> <p>Risk = Personal injury</p>	<p>RF = low</p>	

	All participants Risk = Personal injury/illness	Encourage hand sanitizing before eating  RF = low	
Agricultural chemicals			
WORK SPECIFIC		Encourage participants to drink plenty of water and take regular breaks  RF = low	
Dehydration	All participants Risk = Personal injury/illness		
		Encourage participants to take scheduled breaks and vary tasks to mitigate risk of fatigue  RF = medium	
Fatigue	All participants Risk = Personal injury		
	All participants Ropes and pegs along the ground,	Brightly coloured ropes used for visibility, pegs removed if not fixing position of ropes. Encourage caution when walking, walking only – no running  RF = medium	

<b>Trip hazards – laying grids</b>	<b>Risk = Personal injury</b>	<b>Brightly coloured ropes used, lower pace set on magnetometer.</b>	
	<b>Fred only</b>		
	<b>Risk = Personal injury</b>	<b>Encourage the wearing of appropriate footwear.</b>	
		<b>RF = medium</b>	
<b>Trip hazards - Surveying</b>	<b>All participants</b>		
	<b>Risk = Personal injury</b>	<b>Avoid inhaling paint fumes and wash hands after spraying</b>	
<b>Slip Hazard – wet weather</b>			
	<b>All participants</b>		
	<b>Personal injury/illness</b>	<b>Advise participants to have an up-to-date tetanus</b>	
<b>Spray paint</b>			
	<b>All participants</b>	<b>Encourage hand sanitizing before eating</b>	
<b>OTHER</b>	<b>Risk = illness</b>		



<p><b>Tetanus</b></p>	<p><b>All participants</b></p> <p><b>Risk = illness</b></p>		
<p><b>Food hygiene</b></p>			

Signed

NAME ..... SIGNATURE ..... NAME ..... SIGNATURE .....

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NAME ..... SIGNATURE ..... NAME ..... SIGNATURE .....

## RISK ASSESSMENT FORM

(BASED ON HSE "FIVE STEPS TO RISK ASSESSMENT")

Sheet No :.....1.....

Department/Section ...Classical and Archaeological Studies

Work Area ...Blean church south-west.....

Date of Assessment .....16/01/2018.....

Assessor .....Fred Birkbeck.....

Signature .....

Date of Review .....

<b>HAZARD</b> (List)	<b>PERSONS AT RISK AND HOW</b> (Consider all persons, including those who may not be involved with the job)	<b>EXISTING CONTROL MEASURES AND ADEQUACY</b> (List the control measures appropriate to each hazard and consider the level of residual risk; is it high, medium or low?) If using a risk matrix then show risk factor (RF) = (hazard x risk)	<b>ADDITIONAL REQUIREMENTS</b> (If the residual risk is high, you must take additional practicable measures to reduce it, or abort the proposed task)
<b>ENVIRONMENTAL</b>			

<b>Wet weather</b>	<b>All participants</b> <b>Risk = Illness</b>	<b>Encourage participants to wear waterproof clothing and bring dry clothes to change into.</b>  <b>RF = low</b>	
<b>Lightning Strike</b>	<b>All participants</b> <b>Risk = Personal injury</b>	<b>Vacate site if lightning storm thought to be imminent</b>  <b>RF = medium</b>	
<b>SITE SPECIFIC</b>			
<b>Fences and boundaries</b>	<b>All participants</b> <b>Barbed wire fences and brambles</b> <b>Risk = Personal injury</b>	<b>Use only open entrances to site, take necessary care when working close to hazardous boundaries.</b>  <b>Basic first aid equipment available (plasters)</b>  <b>RF = medium</b>  <b>Avoid contact with dogs</b>  <b>RF = low</b>	
<b>Animals and livestock</b>	<b>All participants</b>		



<p><b>Moving vehicles</b></p>	<p><b>No livestock present on site, occasional dog walkers</b></p> <p><b>Snakes</b></p> <p><b>Risk = Personal injury</b></p> <p><b>All participants</b></p> <p><b>Car park area is open to the public reversing and driving into parking spaces</b></p> <p><b>Possible farm machinery in operation on adjacent fields,</b></p> <p><b>Cyclists on public path along the east of the site</b></p> <p><b>Drivers may be unsighted, low risk of collision due to low speeds</b></p> <p><b>Risk = Personal injury</b></p> <p><b>All participants</b></p> <p><b>Risk = Personal injury/illness</b></p>	<p><b>Take care around the car park and public path, be vigilant when entering and exiting site for cyclists and particularly farm machinery</b></p> <p><b>RF = low</b></p> <p><b>Encourage hand sanitizing before eating</b></p> <p><b>RF = low</b></p>	
<p><b>Agricultural chemicals</b></p>		<p><b>Encourage participants to drink plenty of water.</b></p>	
<p><b>WORK SPECIFIC</b></p>			

<p><b>Dehydration</b></p>	<p><b>All participants</b> <b>Risk = Personal injury/illness</b></p>	<p><b>RF = low</b></p> <p><b>Encourage participants to take scheduled breaks and vary tasks to mitigate risk of fatigue</b></p>	
<p><b>Fatigue</b></p>	<p><b>All participants</b> <b>Risk = Personal injury</b></p>	<p><b>RF = medium</b></p>	
<p><b>Trip hazards – laying grids</b></p>	<p><b>All participants</b> <b>Ropes and pegs along the ground, brambles hidden in long grass.</b> <b>Risk = Personal injury</b></p>	<p><b>Brightly coloured ropes used for visibility, pegs removed if not fixing position of ropes. Encourage caution when walking, walking only – no running</b></p> <p><b>RF = medium</b></p>	
<p><b>Trip hazards - Surveying</b></p>	<p><b>Fred only</b> <b>Risk = Personal injury</b></p>	<p><b>Brightly coloured ropes used, lower pace set on magnetometer.</b></p> <p><b>Encourage the wearing of appropriate footwear – preferably wellington boots due long grass.</b></p> <p><b>RF = medium</b></p>	

<b>Slip Hazard – wet weather</b>	<b>All participants</b> <b>Risk = Personal injury</b>	<b>Wear steel toe capped boots to avoid injury from sharp probes on gradiometer.</b> <b>RF = medium</b>	
<b>Equipment hazard – resistivity</b>	<b>Fred only</b> <b>Risk = Personal injury</b>	<b>Avoid inhaling paint fumes and wash hands after spraying</b>	
<b>Spray paint</b>	<b>All participants</b> <b>Personal injury/illness</b>	<b>Advise participants to have an up-to-date tetanus</b>	
<b>OTHER</b>		<b>Encourage hand sanitizing before eating</b>	
<b>Tetanus</b>	<b>All participants</b> <b>Risk = illness</b>		



Food hygiene	All participants Risk = illness		
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Signed

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**11.3. Poster informing local residents**

# **Blean and Gone**

## **An archaeological geophysical survey of ancient Blean at St Cosmus and St Damian Church**

Over the course of January and February students from the University of Kent are undertaking a licensed archaeological survey of the scheduled monument located south-west of the church. The project is in addition to a survey carried out in the field to the east of the church in September 2017.

The objective is to analyse the underground features of the area thought to be the settlement that evolved into the Blean we know today.

The survey will involve magnetometry and resistivity techniques that attempt to detect underground features and digitise them for further analysis. The techniques avoid any disturbance of the archaeology and there are no plans to excavate. This is not part of a planned development or any other future use of the land, it is purely part of an undergraduate dissertation project being prepared by Fred Birkbeck – the lead surveyor.

The results will be published as a dissertation and a report filed with Historic England for the national record. There will also be a presentation to members of the public later in the year.

If you see anybody that either has something other than surveying equipment, is metal detecting or disturbing the ground in any way or cannot produce the appropriate license when asked, they may be breaking the law.

Please feel free to approach us in the field if you have any questions, concerns or if you want to lend a hand!

**Contact details for the lead surveyor:**

Fred Birkbeck – [fb249@kent.ac.uk](mailto:fb249@kent.ac.uk)

#### **11.4. Technical appendix**

##### **11.4.1. Magnetometry**

A Bartington Grad601-2 dual fluxgate gradiometer (shown in figure 17 in Field 1) property of the University of Kent, was used to conduct the magnetometer surveys. The surveys were conducted in 30m x 30m grids

**11.4.2.** Grids were set out in the field using an RTK GPS system. In Field 1 three back sights were plotted and a total station was then used to plot grid intersection points downloaded from a GIS system and triangulated using the OSGB:27700 coordinate reference system to the back sights. In Field 2 the grid intersection points were plotted at the desktop in Quantum GIS and downloaded to a pen drive for transfer to an RTK GPS system, the points were then plotted in the field using the satellite RTK link to OSGB coordinates.

**11.4.3.** The traverse separation was set at 1m and the sample intervals at 0.25m, the geomagnetic field gradient was measured in nanoTesla (nT) and instrument sensitivity was set to 0.1nT.

**11.4.4.** The complete 30m x 30m grid squares were surveyed in a zig-zag pattern as shown in figure 18. a trapeze to mark the 1m intervals along each traverse was not considered necessary due to the resources and time available and a constant pacing was instead employed assisted by the audible bleep from the gradiometer. In order to maintain a straight-line traverse a cone was placed at the interval knot or tape mark at the end of each traverse and moved at the completion of each traverse to the next marker, figure 19 shows the system in operation. Partial grids that were not a complete 30m x 30m were completed using a parallel pattern due to the diagonal angle significantly altering the length of each traverse. The 30m ropes were laid out on the east and west ends of the grids to facilitate an east-west traverse direction with knots marking the traverses at the 1m point and every 2m thereafter. 60m plastic coated washing lines with electrical tape marking the y axis traverse points were also employed in the same way to mark out two grids at a time, these were less robust than the ropes but were not as susceptible to stretching or contraction and a more robust version will be considered as a preferential alternative to ropes in the future. Additional GPS points were plotted between the 0m and 30m traverse lengths for the partials and a rope stretched across to ensure traverses were performed at right angles to the base line. Due to the north-south gradient of the fields east-west traverses were employed to eliminate the chance of inconsistent pacing from uphill and downhill traverses in the absence of trapezes.

**11.4.5.** A point in the field was scanned to establish an area of low variation in the magnetic responses and was selected as a zero point. The magnetometer was adjusted every four grids or every 2 hours, whichever came first, to ensure consistent readings across the site.

**11.4.6.** The survey results were automatically saved to the gradiometer's internal memory for download at the end of each day onto a laptop in the field. The data was then processed and adjusted using TerraSurveyor 3.0.33.1 at an office-based computer.

##### **11.4.7. Resistivity**

Resistivity was carried out within the scheduled monument area of Field 2 using the Geoscan RM85 resistance meter in figure 21, property of the University of Kent.

**11.4.7.1.** The resistivity meter was configured with two parallel twin-probe arrays. The twin probe (electrode) configuration is one that has been developed specifically for archaeology



(Clark, 1990, 43) and the Geoscan RM85 allows for two such arrays to be set up side-by-side to double the traverse width and complete two at once. The resistance gradient was measured in Ohms.

- 11.4.7.2.** The survey was conducted over the same 30m x 30m grids as laid out for the magnetometry survey with a zig-zag traverse pattern employed. Ropes were marked with 2m intervals on the east and west ends of the grids and ropes with knots at 50cm intervals after the first 25cm were employed as trapezes to mark the contact points for the probes. The ropes were abandoned as trapezes after considerable warping due to the newness of the ropes and the wet conditions of the field rendered them unreliable and fibreglass tapes were used instead. Volunteers were employed to manage the cables that were attached to the remote sensors, which had to be placed at least 30m away from the mobile array, to expediate smooth and constant operation of the mobile probe array. Cones marking the end of the traverses were not required.
- 11.4.7.3.** Due to the scheduled status of area G, it was necessary to adapt certain aspects of the method, thinner aluminium pegs were required to be used instead of the plastic ones used in Field 1 and volunteers were under strict instructions to cause as little disturbance as possible to the area, especially when inserting or removing pegs and any material of a potentially archaeological nature such as building material, pottery or artefacts found on the surface were to be left *in situ*.

## **11.5. Data processing**

- 11.5.1.** TerraSurveyor 3.0.33.1 was used to process the raw data from the magnetometer and resistivity surveys and produce results in greyscale plots on a continuous black to white gradient with the natural (zero point in the results) displayed as 50% grey.
- 11.5.2.** Magnetic anomalies appeared on the TerraSurveyor images relative to the zero point with positive responses darkening to black and negative responses lightening to white. On the resistivity results, the areas of high resistivity darkened to black and low resistivity lightened to white.
- 11.5.3.** The following processes were applied the raw magnetometer results to aid interpretation:
- **Destripe:** used when differences caused by directional effects inherent in magnetic instruments, orientation of the instrument, changes in the setup of the instrument or delays between grids cause alternating light and dark traverses conducted in a zigzag pattern. The destripe function will set the mean of all traverses close to zero or a common value for all traverses
  - **Interpolate:** the interpolate function is used to either increase or decrease the resolution of the survey by creating new data points between the existing data points at both x (horizontal) and y (vertical) axes. This does not enhance the data but produces a smooth curve to fit the available data points
  - **Despike:** used with magnetometer data to remove anomalous strong spikes in the data caused by small surface or sub-surface ferrous objects. The despike function replaces

those values that exceed the mean by a specified threshold with the mean amount or the threshold

- Clip: the clip function removes extreme datapoint values by replacing the minimum and maximum readings with either absolute values or by +/- standard deviations

Interpolation, despiking and clipping were also applied to the resistivity results as was:

- High pass filter: used to remove high and low frequency components within a set window in the data. The user specifies the number of x and y points either side of the centre (e.g. a diameter of 1 = no filter applied, diameter 15 = the centre point plus 7 datapoints either side) the datapoints either side are then given a uniform weighted mean which is subtracted from the centre value

**4.2.4.** Two types of magnetic anomaly have been identified in the magnetometry geophysical data. The magnetic data can be described as falling into two classes

- Monopolar: anomalies that have only a single magnetic pole, giving a single dark or light response on the survey data plan. These maybe interpreted as soil-filled cut features, such as ditches and pits or stone walls.
- Dipolar: anomalies that have localised positive and negative responses, usually caused by ferrous objects on or just under the surface or earth that has been exposed to extreme heat such as kilns or hearth, a phenomenon known as thermoremanence.

**4.2.5.** Graphics showing the representation of the survey results were produced using QGIS 2.18.17 and GIMP 2.8.22. Base map data were obtained under license from the EDINA Digimap/JISC service and are © Crown Copyright Ordnance Survey 2018. LiDAR data gathered by The Environment Agency and made available under Open Government License have been used for interpretation, mapping and illustration. All instances of its use are © Environment Agency copyright and/or database right 2018. All other images used are property of the author unless otherwise stated.