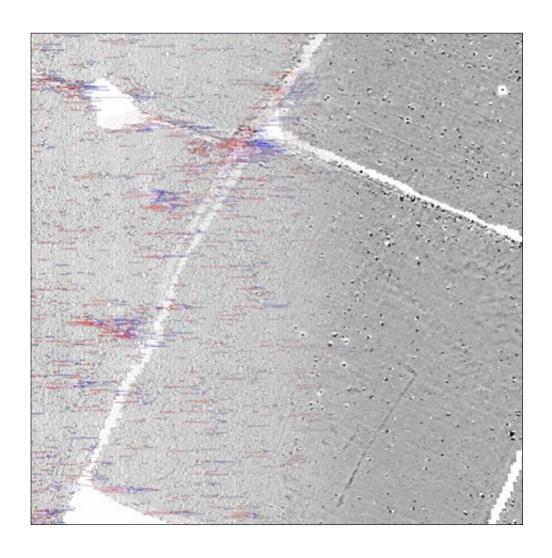


**Detailed Gradiometer Survey Report** 



Ref: 101400.01 February 2014





# **Detailed Gradiometer Survey Report**

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# **Detailed Gradiometer Survey Report**

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Table 1: Survey area names, size, condition and progress of survey



# **Detailed Gradiometer Survey Report**

## **Summary**

Wessex Archaeology was commissioned by CgMs Consulting Ltd on behalf of their client Roxhill Developments to undertake a detailed gradiometer survey over the area of the proposed East Midlands Gateway development (centred on NGR 447150 327075), with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features on the site as part of a programme of archaeological works, ahead of proposed development.

The site is located approximately 10km northwest of Loughborough and 14.5km southeast of the centre of Derby; in between Castle Donington to the west and Kegworth to the east. The largest area of the site comprises an area of mainly arable agricultural land located directly to the north of East Midlands Airport and west of the M1. There are narrow, linear survey areas to the north and east of the village of Lockington and another linear survey area located to the south of Kegworth.

Detailed gradiometer survey was undertaken over all accessible parts of the site, a total of 225ha, and has demonstrated the presence of anomalies of likely, probable and possible archaeological interest in addition to several modern services.

The archaeology detected includes several enclosure complexes, at least one of these relates to human occupation with ring gullies of round houses identified within the enclosure. Some of the other enclosures may have served an agricultural function and may be relatively modern. There are isolated ditch sections scattered throughout the data; some relate to fairly recent former field boundaries but others may indicate earlier field systems. Ridge and furrow was detected in some fields with the north of **A10** in particular shown to contain the greatest concentration of these features.

Some possible Second World War dispersal pens were identified within fields **A10**, **F06** and **F10** as strongly magnetised anomalies linked by roads/tracks. These features correspond to the position of recorded earthworks on early OS maps and are considered to be part of RAF Castle Donington.



# **Detailed Gradiometer Survey Report**

# **Acknowledgements**

The detailed gradiometer survey was commissioned by CgMs Consulting Ltd. The assistance of Sally Dicks and Luke Wayman is gratefully acknowledged in this regard.

The fieldwork was carried out by Philip Roberts, Michael Keech, Michael O'Connell, Matthew Weightman, Chris Hirst, Philipp Maier, David Loeb, Jonathan Buttery and Laurence Savage. The geophysical data was processed by Ross Lefort and Laura Andrews and Ross Lefort interpreted the geophysical data in addition to writing this report. The geophysical work was quality controlled by Dr. Paul Baggaley and Ben Urmston. Illustrations were prepared by Linda Coleman. The project was managed on behalf of Wessex Archaeology by Andrew Norton.



# **Detailed Gradiometer Survey Report**

### 1 INTRODUCTION

### 1.1 Project Background

- 1.1.1 Wessex Archaeology was commissioned by CgMs Consulting on behalf of their client Roxhill Developments to carry out a programme of geophysical survey over land comprising the East Midlands Gateway, Leicestershire (centred on NGR 447150 327075) (**Figure 1**), hereafter "the Site".
- 1.1.2 The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of a strategic rail freight interchange at the Site. The size of the Site, defined by CgMs Consulting, comes to 278.7ha and is composed of 12 distinct areas that are detailed in **Figure 1** and the following table:

Survey Area Name	Total Area (ha)	Surveyable	Survey Completed
A1	1.8	No, woodland	No
A2	7.4	Partially, some woodland	Yes
A3	2.6	Yes	Yes
A4	1.3	Yes	Yes
A5	8.9	Yes	Partially, access issues
A6	4.9	Yes	Mostly, access issues
A7	1.1	Yes	Yes
A8	4.1	Yes	Yes
A10	196.8	Mostly, some woodland	Mostly, access issues
A10R	7.3	Yes	Yes
Airport	33.2	Mostly, some woodland	Partially, access issues
A50	9.3	Yes	Yes
Total	278.7		

Table 1: Survey area names, size, condition and progress of survey

- 1.1.3 An archaeological Desk-Based Assessment (DBA) was carried out by CgMs Consulting (2013) and will be referred to in relation to the interpretation of certain geophysical anomalies.
- 1.1.4 The most significant recorded features within the geophysical survey area include two possible Roman roads (MLE4636 & MLE4658), a barrow cemetery (MLE4687), medieval field systems (MLE4678), a possible cropmark enclosure (MLE4682), a post-medieval windmill (MLE4684), the Derby to Weston & Trent railway (MLE16135) and Castle Donington airfield (MLE15963). These records will be referred to, where relevant, in the detailed interpretation of the geophysical anomalies found.



- 1.1.5 A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology (2013) that set out the following aims for the gradiometer survey:
  - Conduct a detailed gradiometer survey that covers as much of the specified area as possible, allowing for artificial obstructions.
  - Clarify the presence/absence and extent of any buried archaeological remains within the Site.
  - Clarify the general nature of the remains present.
  - Produce a report which will present the results of the geophysical survey in sufficient detail, to support an informed decision to be made concerning the Site's archaeological potential.
- 1.1.6 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

### 1.2 Site Location and Topography

- 1.2.1 The Site is located approximately 10km northwest of the centre of Loughborough and 14.5km southeast of the centre of Derby. The Site comprises mainly arable agricultural land with the main bulk of the survey area located directly north of East Midlands Airport and to the west of Junction 24 of the M1 (Figure 1). Some more isolated linear and curvilinear survey areas are present around the village of Lockington and south of Kegworth (Figure 1). The Site lies in between Castle Donington to the west and Kegworth to the east with the villages of Hemington and Lockington to the north and Diseworth to the south.
- 1.2.2 Areas **A1**, **A2**, **A3** and **A4** are located to the west of the M1. Area **A1** lies within a wooded area surrounded by junction 24a of the M1; the area was deemed unsuitable for geophysical survey. Area **A2** is mostly covered by woodland but a small strip lies within an arable field and was deemed surveyable; areas **A3** and **A4** are located within arable farmland. The land in this region is fairly flat at a height of around 30m above Ordnance Datum (aOD) and sits on an area of floodplain close to the River Trent. The survey extents are defined by field boundaries and the limits of the proposed development.
- 1.2.3 Areas **A5**, **A6** and **A7** are located to the east of the M1 and are all located in areas of arable farmland. The relief is fairly flat on a slight slope; the highest area is located towards the south at around 35m aOD and slopes down to the north to around 30m aOD. Area **A8** is an arable field located on the west side of the M1, opposite **A7**, within junction 24. This field lies at a height between 35m and 40m aOD. These areas are partially defined by field boundaries and the limits of the proposed development.
- 1.2.4 Area **A10R** runs from the southeast corner of **A10** towards the east; this survey area forms the proposed route of the Kegworth bypass. The route follows the south facing side of a valley of an unnamed stream that flows eastward into the River Soar. The land falls from west to east from over 75m aOD to under 50m aOD; the highest point of the survey area lies at Broad Hill at a height of 83m aOD. The western survey extent is defined by the M1 and the eastern extent is defined by London Road; the northern and southern extents are defined by the limits of the proposed bypass.
- 1.2.5 The **Airport** area is located to the southwest of **A10** within an area occupied by the former site of RAF Castle Donington, close to the East Midlands International Airport. The land is mostly covered with arable farmland although there are some wooded regions and grassed fields near the airport. The land slopes down from over 90m aOD at the south to just over 60m aOD towards the north. The survey area is defined by a track to the west,



East Midlands Airport to the south and field boundaries and the edge of **A10** to the north and east.

- 1.2.6 The bulk of the Site lies within area **A10** which is located directly in between Castle Donington and Kegworth. **A10** occupies an area of undulating land that is largely composed of arable farmland along with a few areas of woodland. The highest areas of the Site are located near the airport to the south at a height just under 90m aOD and this falls towards the north to a height less than 40m aOD. The northern boundary of **A10** follows field boundaries that run close to the edge of the floodplain area of the River Trent; the other survey extents are defined by field boundaries to the west, the airport to the south and the M1 to the east. A few small watercourses run through **A10** and these form tributaries of the River Trent further north.
- 1.2.7 Area **A50** is located to the northwest of **A2** in an area of arable land; the relief is flat at around 30m aOD. The survey area is bounded by the Derby to Weston & Trent railway to the northwest, field boundaries to the northeast and the limits of the proposed development to the south.

# 1.3 Soils and Geology

- 1.3.1 Areas **A1** to **A8** and **A50** are spanned by three recorded bands of solid geology with Edwalton member mudstone across the south, a narrow band of Arden sandstone formation across the central region and Branscombe mudstone formation across the north (BGS).
- 1.3.2 The superficial geologies recorded in areas **A1** to **A8** and **A50** all date to the Quaternary period. The northern half of this group of survey areas is made up of a mix of Holme Pierrepont sand and gravel member and Hemington member silt and gravel. The central and southern areas are a mix of Wanlip member sand and gravel and head deposits; area **A8** is recorded as Egginton Common sand and gravel member (BGS).
- 1.3.3 The soils recorded in areas **A1** to **A8** and **A50** are a mix of typical brown alluvial soils of the 561a (Wharfe) association and typical brown earths of the 541r (Wick 1) association (SSEW 1983).
- 1.3.4 The solid geology along the **A10R** area is arranged into alternating bands of Triassic sedimentary geology that runs east to west, parallel to the unnamed stream that runs close by. The bands are made up of Gunthorpe member siltstone and mudstone and Diseworth sandstone. There is possibly a small region of Tarporley siltstone at the far eastern end of the survey area (BGS).
- 1.3.5 There are few superficial deposits recorded within **A10R** apart from a small region of Thrussington member diamicton in the western half of the area, near Broad Hill and a small region of head deposits at the far eastern edge of the survey area (BGS).
- 1.3.6 The soils within **A10R** occur in alternating bands as was the case for the solid geology. These bands include typical argillic pelosols of the 431 (Worcester) association and Stagnogleyic argillic brown earths of the 572c (Hodnet) association (SSEW 1983).
- 1.3.7 The solid geology recorded within **A10** and the **Airport** areas is a mix of sedimentary geologies dating to the Triassic. The south of these areas is recorded as Gunthorpe member siltstone and mudstone with deposits of Diseworth sandstone towards the southeast of **A10**. The northern half of the **Airport** area and central region of **A10** are recorded as Tarporley siltstone formation with regions of Bromsgrove sandstone formation



- to the eastern and western edges of **A10**. The northern edge of **A10** is recorded as Edwalton member mudstone (BGS).
- 1.3.8 There are no superficial deposits recorded in the **Airport** area or the southern half of **A10** although there are scattered Quaternary deposits of head, Egginton Common sand and gravel member, Eagle Moor sand and gravel member and Thrussington member diamicton across the northern half of **A10** (BGS).
- 1.3.9 The soils recorded across **A10** and the **Airport** area includes a band of typical argillic pelosols of the 431 (Worcester) association across the southern limits of the survey area, stagnogleyic argillic brown earths of the 572c (Hodnet) association across the south and east, and typical brown earths of the 541b (Bromsgrove) association to the northwest (SSEW 1983).
- 1.3.10 Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey. There is a possibility, however, that areas of gravel can result in strong background magnetic values that in some cases are capable of obscuring archaeological features.

#### 2 METHODOLOGY

#### 2.1 Introduction

- 2.1.1 The detailed magnetometer survey was conducted using Bartington Grad601-2 dual fluxgate gradiometer systems. The survey was conducted in accordance with English Heritage guidelines (2008).
- 2.1.2 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team between the 23<sup>rd</sup> September 2013 and the 24<sup>th</sup> January 2014. Field conditions at the time of the survey were good, with firm conditions under foot.

#### 2.2 Method

- 2.2.1 Individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (2008).
- 2.2.2 The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with EH guidelines (2008). Data were collected in the zigzag method.
- 2.2.3 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse function (between ±5nT to ±10nT thresholds typically) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. The deslope and multiply functions were used in certain instances to process out grid edge discontinuities and account for differences in sensor height between different operators. These four steps were applied to all survey areas, with no interpolation applied.



2.2.4 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 1**.

#### 3 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION

#### 3.1 Introduction

- 3.1.1 The gradiometer survey has been successful in identifying anomalies of likely, probable and possible archaeological interest across the Site, along with a number of modern services. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2000 (**Figures 2** to **88**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots.
- 3.1.2 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (**Figure 4** to **88**). Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.
- 3.1.3 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

#### 3.2 Gradiometer Survey Results and Interpretation: Areas A2 to A8

- 3.2.1 Fields **A2 F01**, **F02** and **A3 F01** (**Figures 2** to **7**) contain no anomalies of likely or probable archaeological interest. A concentration of trends is visible within **A3 F01**, around **4000**, which may prove to be of archaeological interest. Aside from geological and agricultural features the remaining anomalies within **A3 F01** are small positive anomalies that are classed as possible archaeology and a concentration of dipolar and bipolar responses (black and white) around **4001**. The small anomalies classed as possible archaeology may prove to relate to small archaeological features such as small pits and postholes; they are not interpreted as anything more significant as they do not form noticeable patterns in their spatial distribution. The area of increased magnetic response around **4001** looks to be a concentration of ferrous/ceramic debris; this debris may prove to be modern.
- 3.2.2 The two most noticeable features within **A2 F01** are a ditch-like positive anomaly at **4002** and a broad band of positive and negative anomalies around **4003**. The possible ditch runs parallel to the southern boundary of this field; this feature is classed as possible archaeology as there is a possibility it relates to more recent use of this area for agriculture. The band of responses around **4003** looks to be geological and roughly follows the edge of the floodplain of the River Trent. The wider band is classed as superficial geology but the strongest positive anomalies (over +3nT) within are classed as possible archaeology. This geological band may represent an area of gravels. The remaining anomalies in this field are small positive anomalies and weak linear trends that may prove to be of archaeological interest.
- 3.2.3 **A2 F02** former field boundary aligned east to west is present at **4004** that was coincident with a boundary marked on the 1955 Ordnance Survey map. There are a few east to west aligned trends around **4005**; these trends are broad positive and negative features and are considered to represent remnants of ridge and furrow. The remaining features are small positive anomalies along with a larger linear positive anomaly of possible archaeological interest. There are also numerous weak trends scattered across the field that may prove to be of interest.



- 3.2.4 Areas **A5** and **A6** (**Figures 5** to **10**) contain no anomalies of likely or probable archaeological interest. **A5 F03** contains the continuation of the east to west band of geological responses around **4006** that was noted above in **A2 F01**. Aside from the usual small positive anomalies and weak trends the only other notable feature is a modern service around **4007** that will be discussed in more detail below.
- 3.2.5 Aside from a concentration of trends around **4008** there are few anomalies of interest within **A6 F01**. A modern service is present at **4009** that is a continuation of **4007** and an area of increased magnetic response is present to the south around **4010**; this spread is considered to be modern.
- 3.2.6 A7 F01 (Figures 11 to 13) contains two pit-like anomalies of probable archaeological interest at 4011 and 4012; both are sub-oval in shape with magnetic values over +3nT and lengths around 3m. A very weak crescent shaped positive anomaly with values under +1nT is present at 4013; it is not clear whether this feature is archaeological or geological and has therefore been classed as possible archaeology. A former field boundary is present at 4014 that seems to correspond to a boundary observed on the 1955 OS map. Aside from a number of small positive anomalies and weak trends of possible interest the most noticeable feature is the modern service at 4015.
- 3.2.7 Field **A8 F01** (**Figures 14** to **16**) contains a concentration of archaeological features towards the north with at least three small rectangular enclosures present at **4016** to **4018**. It is unclear what these enclosures represent but they may be related to settlement or agricultural activity; nearby spreads of increased magnetic response may indicate concentrations of occupation debris although it is also possible that this material is modern given the proximity to the M1. There are some disconnected ditch sections around **4019**; given they are on a similar alignment to the enclosures they may be related.
- 3.2.8 There is a linear spread of increased magnetic response around **4020**; this spread is coincident with a former field boundary marked on the 1955 OS map. An isolated linear ditch-like anomaly is present at **4021**. It shares a common alignment with the enclosures further north but is far from them; this feature has been classed as possible archaeology. There are several modern services located in this field at **4022** and **4023**.

#### 3.3 Gradiometer Survey Results and Interpretation: Area A10R

- 3.3.1 Fields A10R F01 to A10R F07 (Figures 17 to 19) contain no anomalies of likely or possible archaeological interest. These fields are covered by wide spreads of increased magnetic response. This enhancement appears to be restricted to certain fields so is considered to be a product of adding magnetic debris along with manure rather than a geological variation. There are numerous trends spread throughout the fields around 4024, 4025, 4029 and 4032; some of these may prove to be archaeological. There are some broad linear anomalies around 4027 that are interpreted as ridge and furrow. There are several modern services visible in the data at 4026, 4028, 4030 and 4031; these will be discussed below. The remaining anomalies are a scatter of small sub-oval positive anomalies that are classed as possible archaeology.
- 3.3.2 Fields A10R F08 to A10R F10 (Figures 20 to 25) contain only two anomalies of archaeological interest at 4034. This pair of features consists of a roughly L-shaped strong positive anomaly and a weaker crescent shaped anomaly. It is unclear what this feature represents but the stronger anomaly has been classed as archaeology and the weaker one as probable archaeology. Linear positive anomalies are present at 4033 and 4035, these features do not appear to define enclosures but appear more agricultural in form. They have been classed as possible archaeology as they cannot be linked to any former



field boundaries. There is a T-shaped spread of increased magnetic response at **4036**; this spread along with the ditch sections at **4039** correspond to former field boundaries. There are three modern services at **4037**, **4038** and **4040** that are discussed in more detail below. The remaining anomalies are small positive anomalies and weak linear trends that may prove to be of archaeological interest.

#### 3.4 Gradiometer Survey Results and Interpretation: Area Airport

- 3.4.1 Field **Airport F02** (**Figures 26** to **28**) contains two anomalies of probable archaeological interest at **4041**; these anomalies appear as two short ditch sections with positive values over +3nT. It is unclear what these features represent as they run out of the field to the west and are obscured by ferrous further east. Both ditch sections are classed as probable archaeology due to their higher magnetic values. There are other positive ditch sections around **4042** but these are classed as possible archaeology as their alignments suggest they are more likely to relate to agricultural activity. There are a number of ceramic field drains and ridge and furrow running across this field around **4043**. The remaining anomalies are weak linear trends and small positive anomalies of possible archaeological interest.
- 3.4.2 **Airport F03** (**Figures 28** to **31**) contains no anomalies of likely or probable archaeological interest. A linear ditch is present at **4044**; this has been classed as possible archaeology as it suspected to be agricultural. A strong negative trend is present at **4045**, its identity is unclear as it follows the line of ploughing but is clearly much stronger than other ploughing trends. The two remaining anomalies of interest are two roads within an area of ferrous responses at **4046** and **4047**. These areas are still visible as roads close to the airport but OS mapping suggests they formed part of the earlier RAF airfield.
- 3.4.3 Airport F08 (Figures 32 to 34) contains two ditch sections at 4048 and 4049 that have positive values over +3nT. The anomaly at 4049 has weaker regions less than +2nT and runs parallel to the field boundary further north whereas 4048 does not appear to follow any existing boundaries. Both have been classed as probable archaeology although the weaker parts of 4049 have been classed as possible archaeology. There are other isolated ditch sections such as those around 4050; they have weaker magnetic values under +2nT and have been classed as possible archaeology. A number of former field boundaries and tracks are visible in the data as concentrations of ferrous responses and spreads of increased magnetic response such as at 4051 to 4053. These boundaries are marked on the 1921-1922 OS maps. The remaining anomalies are some areas of ridge and furrow, weak linear trends and small positive anomalies of possible archaeological interest.

### 3.5 Gradiometer Survey Results and Interpretation: Area A10

- 3.5.1 Fields **A10 F01**, **F02**, **F04** and **F05** (**Figures 35** to **37**) contain few anomalies of archaeological interest. **A10 F01** contains very little besides ridge and furrow around **4054**, weak linear trends and small positive anomalies of possible interest.
- 3.5.2 **A10 F02** contains an L-shaped ditch section at **4055** with magnetic values less than +2nT. The function of this ditch is unclear as it does not follow the alignment of current field boundaries and does not form an obvious enclosure. This feature may form part of an earlier field system and is considered to be of probable archaeological interest. The remaining anomalies in this field include ridge and furrow around **4056**, weak linear trends and small positive anomalies of possible archaeological interest.



- 3.5.3 Fields **A10 F04** and **F05** contain very little aside from ridge and furrow (**4057**), field drains and occasional trends. There are a few positive anomalies of possible interest towards the north of these fields.
- 3.5.4 Fields **A10 F06** and **F07** (**Figures 38** to **40**) appears to be divided into two fields but the boundary is a change in use rather than a physical boundary and was surveyed as a single field. These fields contain a concentration of archaeology towards the north in the form of enclosures along with some airfield features towards the south.
- 3.5.5 There are some features that are considered to relate to the RAF airfield in the data at 4058 and 4059; the former corresponds to a track marked on modern OS maps but is considered to be a surviving part of the Second World War airfield complex. The responses south of 4059 appear to be a block of structures similar to those observed within A10 F10 although only a small area of this block has been covered by geophysical survey. The strong magnetic values of these features suggest that metallic/ceramic material forms part of the material used to construct them. OS mapping from 1962-1963 shows groups of structures flanked by earthworks. The function of these features is unclear but they are classed as archaeology as they most likely relate to RAF Castle Donington.
- 3.5.6 A small sub-rectangular enclosure is present around **4060** with weak magnetic values less than +1.5nT apart from a short length with values over +3nT. Aside from a weak linear classed as possible archaeology further north the enclosure is fairly isolated. The function of this enclosure is unclear but has been interpreted as probable archaeology with the stronger ditch section interpreted as archaeology.
- 3.5.7 There is a dense group of adjoining enclosures further north at **4061** to **4066**; all enclosure ditches have weak values with the strongest around +2nT and the weakest sections around +1nT. The enclosures are all sub-rectangular and sub-triangular in shape and many have internal sub-divisions. There are possibly more fragmented enclosures on the edge of the central group mentioned above with fragmented ditch sections visible at **4067**, **4069** and **4070**. A parallel pair of ditches is present at **4068** and this may define a track or droveway. There are some spreads of increased magnetic response within and around these enclosures; the spreads not related to former field boundaries may represent concentrations of artefacts including ceramic/metallic objects.
- 3.5.8 A number of former field boundaries are visible in the data as ditch sections, trends and spreads of increased magnetic response. The junction of four boundaries is present at **4071**, three boundaries are visible around **4072** and a single boundary is visible at **4073**. The remaining features include ridge and furrow (**4074**), weak linear trends and small positive anomalies of possible archaeological interest.
- 3.5.9 Field **A10 F08** (**Figures 41** to **43**) contains no anomalies of likely or probable archaeological interest. The only notable features are a few interesting trends such as at **4075**, ridge and furrow at **4076** and a short ditch section at **4077** that is classed as possible archaeology. A former field boundary marked on the 1955 OS map runs through the middle of the field at **4078**.
- 3.5.10 A10 F09 (Figures 41 to 43) contains a probable enclosure at 4079 to 4081 with some isolated ditch sections around 4082. The ditches have very weak magnetic values less than +1.5nT. The eastern side of this enclosure is well defined but a western side is harder to find. A former field boundary is visible at 4083 that corresponds to a boundary marked on the 1955 OS map; it is possible that this boundary defines the western side of the enclosure. The function of this enclosure is unclear but its alignment with more recent



- boundaries may suggest it served an agricultural function. The remaining anomalies in this field include ridge and furrow (4084), geological features, weak linear trends and small positive anomalies of possible archaeological interest.
- 3.5.11 Field **A10 F10** (**Figures 44** to **46**) contains the continuation of the suspected Second World War features observed in **A10 F06**. A complete row of structures is visible at **4085** to **4090** that are surrounded by a road (**4091**) leading to the other group of buildings in **A10 F06** at **4059**. The row of structures consists of four rectangular features at **4087** to **4090** that are flanked by two larger features at **4085** and **4086**. All of these anomalies possess high values that suggest these structures represent features built using a large amount of ceramic and/or metallic material. There were no upstanding features so it's unclear whether these rectangular areas represent building foundations or flat concrete platforms. These features are visible on early OS mapping and it is likely that they belong to the former RAF airfield located here; as a result of this association these anomalies have been classed as archaeology.
- 3.5.12 Away from the airfield features are a couple of straight ditches at **4092** and **4093**; the former lines up with an L-shaped ditch section further north in **A10 F12** and may be related. Both ditches have magnetic values around +1.5nT and have been interpreted as probable archaeology, possibly representing sections of an earlier field system. There is a former field boundary at **4095** that has been observed in a number of early OS maps. A line of elongated spreads of increased magnetic response run perpendicular to this boundary at **4094**; it is possible that this also represents a field boundary or track although no boundaries can be seen in this location on the available OS maps. The remaining anomalies include weak linear trends and small positive anomalies of possible archaeological interest.
- 3.5.13 **A10 F11** (Figures **44** to **46**) contains no anomalies of likely or probable archaeological interest. The only notable features are a few interesting trends such as at **4096** and a former field boundary at **4097**. The remaining anomalies include small positive anomalies of possible interest.
- 3.5.14 Fields **A10 F12**, and **F13** (**Figures 47** to **49**) contains anomalies of likely and probable archaeological interest with a probable settlement enclosure observed within **A10 F13**. Three isolated ditch sections are visible at **4098** to **4100**; the first may link up with a linear observed in **A10 F10** as they appear to line up. All three have weak magnetic values less than +2nT and none of them appear to form obvious enclosures. **4098** and **4099** have been interpreted as probable archaeology and **4100** has been interpreted as possible archaeology as its diffuse nature suggests it could be geological.
- 3.5.15 Two ring ditches are visible in **A10 F13** at **4101** and **4102**; the latter extends out beyond the eastern field boundary and only half of it is visible. These ditches have fairly weak magnetic values less than +1.5nT and both measure around 12m in diameter. **4101** contains some internal pit-like features with higher magnetic values over +3nT. These ring ditches appear to represent gullies of round houses rather than barrow ditches as the complete example at **4101** has a break in its southeast side flanked by stronger sub-oval anomalies similar to those expected from postholes. The southeast side is the expected location for an entrance into a round house and being flanked by postholes suggests a deliberate break in the gully rather than a loss of contrast in this region. A possible entrance into **4102** cannot be seen as its southeast side lies outside of the survey area. Both of these features are interpreted as archaeology and the small internal features are interpreted as probable and possible archaeology depending on size and strength of the anomaly.



- 3.5.16 These probable round houses are located within a sub-rectangular enclosure defined by ditches at **4103**, **4105** and **4106** with a possible internal division at **4104**. The magnetic values of these ditches varies widely from under +1nT to over +3nT and they are classed as archaeology, probable archaeology and possible archaeology according to the strength of their fills. The eastern end of this enclosure is not visible as it appears to extend further outside of this field. The remaining anomalies in this field include weak linear trends and small positive anomalies of possible archaeological interest.
- 3.5.17 A10 F14 (Figures 47 to 49) contains two ditch sections at 4107 and 4108 that have magnetic values around +1.5nT and alignments that differ to the present field boundaries. As a result of this both have been classed as probable archaeology. The remaining features include ditch sections aligned parallel to field boundaries such as at 4109 (classed as possible archaeology), ridge and furrow (4110), weak trends and small anomalies of possible interest.
- 3.5.18 Field **A10 F15** (**Figures 50** to **52**) lies to the east of **A10 F13** where a settlement enclosure was identified. No continuation of this enclosure was identified within this field and it is considered that the enclosure may have terminated within the wooded strip between these two fields. This field contains no anomalies of likely or probable archaeological interest. The only notable features are a very weak curvilinear positive anomaly at **4111** that was interpreted as possible archaeology, a former field boundary around **4112** and ridge and furrow around **4113**.
- 3.5.19 **A10 F19** (**Figures 53** to **55**) contains no anomalies of likely or probable archaeological interest. The only notable anomalies are weak linear ditches at **4114** (classed as possible archaeology), spreads of increased magnetic response as at **4115**, weak trends (**4116**) and a large concentration of ferrous anomalies around **4117**.
- 3.5.20 Field **A10 F20** (**Figures 53** to **55**) contains at least one enclosure within its northern half that is defined by ditch sections at **4118** to **4120**. These ditches have magnetic values around +2nT but there are weaker areas such as at **4120** where values are around +1nT. There are smaller isolated ditch sections at **4021** to **4023** that are variously classed as archaeology, probable and possible archaeology depending on their orientation and strength of response. There is a spread of increased magnetic response within the enclosure around **4124** and another further to the southeast outside the enclosure; these spreads may indicate concentrations of artefacts but could also prove to be modern. The remaining anomalies within this field include weak linear trends and small positive anomalies of possible archaeological interest.
- 3.5.21 Fields **A10 F22** and **F24** (**Figures 56** to **58**) contain no anomalies of likely or probable archaeological interest. There are several ditch sections scattered throughout the data at **4125**, **4127** and **4128** that are classed as possible archaeology as they may relate to agricultural activity. There are some former field boundaries defined by short ditch sections, trends and spreads of increased magnetic response in **A10 F24** with **4129** sitting at the junction between two former boundaries. The remaining features are small spreads of increased magnetic response (**4126**), weak linear trends (**4130**) and small positive anomalies of possible interest.
- 3.5.22 Fields **A10 F25** and **F26** (**Figures 59** to **61**) contain no anomalies of likely of probable archaeological interest. Aside from a few trends like **4131** and a spread of increased magnetic response around **4134** the only two notable features are a former field boundary at **4132** and a line of ferrous anomalies at **4135**. There are two modern services (possibly a single service) at **4133** and **4136** but these will be discussed below.



- 3.5.23 A10 F27 (Figures 59 to 61) contains a probable pit at 4137 that is sub-circular in shape and measures 10.5m in diameter. A small irregular shaped area within this pit possesses the highest values over +3nT but the bulk of the anomaly measures less than +1.5nT. The strongest area is classed as archaeology and the weaker region as probable archaeology. The remaining anomalies are a mix of weak linear trends as at 4138, ridge and furrow (4139) and small positive anomalies of possible archaeological interest.
- 3.5.24 Field **A10 F29** (**Figures 62** to **64**) contains no anomalies of likely or probable archaeological interest. Aside from weak trends and small positive anomalies of possible interest the only notable features are a group of ceramic field drains around **4140**.
- 3.5.25 Field **A10 F30** (**Figures 62** to **64**) contains two isolated ditch sections of probable archaeological interest at **4141** and south of **4142**; the former has weak values around +1.5nT and the latter has values over +3nT. A weaker linear is present around **4143** with values around +1nT; this feature is classed as possible archaeology. A former field boundary runs through the middle of this field at **4142** that is marked on the 1955 OS map. The remaining anomalies include areas of increased magnetic response as at **4144**, ridge and furrow (**4145**), weak trends and small anomalies of possible archaeological interest.
- 3.5.26 Field **A10 F31** (**Figures 62** to **64**) contains no anomalies of likely or probable archaeological interest. There are three linear features running through the data: the first is a spread of increased magnetic response at **4146**, the second is a ditch of a former field boundary at **4147** and the third is a line of ferrous responses at **4148**. Only **4147** can be linked to a former field boundary with any confidence with **4146** corresponding to the position of a path. The line of ferrous at **4148** may also correspond to a boundary that existed prior to the development of the M1. The remaining anomalies include weak linear trends and a scatter of small positive anomalies of possible interest.
- 3.5.27 Field **A10 F32** (**Figures 65** to **67**) contains one anomaly of archaeological interest at **4149**; it is a linear with values around +1.5nT that forms part of the complex observed in **A10 F20** and has been interpreted as archaeology. The only other anomaly of interest is an elongated spread of increased magnetic response at **4150**; this spread coincides with a former field boundary and track that is present on the 1972 edition OS map.
- 3.5.28 Field **A10 F33** (**Figures 65** to **67**) contains no anomalies of likely or probable archaeological interest. There are a pair of parallel ditches at **4151** with weak values less than +1.5nT; these ditches run from the end of a track to the south into the middle of the field before fading into a weak trend. This feature may be an old track but could also be relatively modern; no map features can be found relating to these anomalies that have been classed as possible archaeology. Another weak intermittent ditch is present at **4152** that has also been interpreted as possible archaeology. The remaining anomalies include weak linear trends (**4153**), a broad area of superficial geology (**4154**) and numerous small positive anomalies of possible archaeological significance.
- 3.5.29 A10 F34 (Figures 68 to 70) contains only one anomaly of possible archaeological significance at 4155. This feature appears to be a ditch with values around +1.5nT to the north but appears to weaken and broaden out into a diffuse feature. The strong region has been interpreted as probable archaeology and the weaker region as possible archaeology. A similarly weak linear is present at 4157 that runs perpendicular to the one above; it is possible that both these features represent former field boundaries or tracks given their common alignment with the nearby boundaries. The remaining anomalies include short isolated ditch sections such as 4156, ridge and furrow (4158) and weak linear trends.



- 3.5.30 Field **A10 F35** (**Figures 71** to **73**) contains a group of small enclosures around **4159** to **4162**. These enclosures measure between 10m and 30m in length and have weak values ranging from less than +1nT to a little over +2nT. The enclosures appear incomplete and it is possible that some more ditch sections are present but their fills are magnetically sterile and are therefore not detectable through gradiometer survey. There are some internal features such as pit-like features and internal dividing ditches. The function of these enclosures is unclear but all have been interpreted as either archaeology or probable archaeology depending on the strength of their fills. A pit is located further north at **4163** may be related to this complex; it has magnetic values over +3nT and is classed as probable archaeology. A weak and isolated ditch section is present at **4164**; it is considered too far from the enclosure complex to be related and has been interpreted as possible archaeology.
- 3.5.31 There are three former field boundaries located within this field with **4165** and **4166** marking the junctions of these boundaries. All three boundaries are marked of early OS maps. A modern service is visible running across the northern edge of this field at **4167**; this will be discussed in more detail below. The remaining features include numerous weak linear trends, geological responses and small positive anomalies of possible archaeological interest.
- 3.5.32 Field **A10 F36** and **F37** (**Figures 74** to **76**) contain a few anomalies of archaeological interest with the greatest concentration lying within **A10 F37**. A group of right angled ditch sections are present at **4168** within a spread of geological responses. These ditches have weak values around +1nT and have been classed as possible archaeology due to their location within an area of geological responses. An intermittent ditch runs up the western side of the field, around **4169**, with typical magnetic values ranging between +1nT and +2nT. This feature is clearly not geological but is classed as possible archaeology as it runs roughly parallel to the nearby boundary that suggests its function is agricultural.
- 3.5.33 Field **A10 F37** contains the clearest archaeological features with at least one enclosure present around **4170** and **4171** that is defined by curvilinear ditch sections. The ditch sections have weak values, less than +2nT, that appear to gradually fade out suggesting that other undetectable ditch sections are present nearby. The function of this enclosure is unclear but the ditch sections have been variously classed as archaeology, probable archaeology and possible archaeology depending on the strength of their fills. There are more right angled ditch sections within and close to the broad band of geological responses at **4172** and **4173**. They seem very regular but their association with geology is a concern; **4172** is classed as probable archaeology **4173** as possible archaeology.
- 3.5.34 Further north are a number of ditch sections of possible interest. The intermittent ditch at 4174 is similar in for to 4169 and it is possible that the two are part of the same feature. A broad weak linear positive anomaly runs through both of these fields with its western end located to the north of 4168; this feature extends from a field boundary on the same alignment suggesting this feature is agricultural in origin. A number of trends are concentrated in the northeast corner around 4175 with a couple of weak ditch sections around 4176; these ditch sections form part of a complex that extends into fields A10 F40 and A10 F41 and will be discussed below. The remaining anomalies include weak trends, broad bands of superficial geology, wide areas of ridge and furrow and small positive anomalies of possible archaeological interest.
- 3.5.35 Field A10 F40 (Figures 77 to 79) contains the continuation of features from both A10 F38 and F41 with a ditch section located at 4177 that joins up with both 4176 and 4185 to form a small sub-rectangular enclosure. This feature will be discussed in more detail in the next section of the report. Further to the southwest is a pair of perpendicular ditches at 4178



- and **4179** that are on the same alignment as this small enclosure. Both have weak magnetic values under +1.5nT and may relate to an earlier scheme of land division; both are classed as possible archaeology as a result. The remaining anomalies include weak linear trends such as at **4180**, a wide area of ridge and furrow around **4181** a modern footpath defined as increased response at **4182** and several small positive anomalies of possible archaeological interest.
- 3.5.36 Field **A10 F41** (**Figures 80** to **82**) contains a number of enclosures including one mentioned above around **4185** that also spans fields **A10 F37** and **F40**. The subrectangular enclosure is defined by ditch sections at **4176**, **4177** and **4185** and measures approximately 40m in length and 25m in width. The ditch sections to the north are stronger with values around +1.5nT and they weaken further South to less than +1nT. There are some internal features formed of weaker ditch sections with another ditch and pit-like anomalies at **4183** and around **4184**. The function of this ditch is unclear but its position at the junction of a number of field boundaries and its orientation suggests it is an earlier feature. The stronger anomalies have been interpreted as probable archaeology and the weaker ones as possible archaeology.
- 3.5.37 Another complex of possible enclosures is present at **4186** to **4188** with strongly magnetised ditch sections detected with values in excess of +3nT and weaker sections around +2nT. The ditch sections fall into two groups of alignments with some roughly north to south (parallel to the eastern boundary) and others aligned northeast to southwest. It is possible that two phases of occupation are represented in this area. The functions of these enclosures are unclear but the ditches are variously interpreted as archaeology, probable archaeology and possible archaeology depending on the strength of their fills. There are spreads of increased magnetic response within and close to this enclosure such as a large spread around **4194**. It is possible that some of these spreads may relate to concentrations of occupation debris but it should be noted that these spreads can be created through the accumulation of modern debris within fields.
- 3.5.38 A pair of parallel ditches is visible at **4189** and **4190** that appear to head towards the southeast corner of this enclosed area. These ditches have values ranging from +1.5nT to over +3nT and may define a track leading from these enclosures. These are more ditch sections that extend off of this possible track and enclosure at **4191** and **4192**. All of these ditches are classed as archaeology, probable archaeology or possible archaeology according to the strength of their fills. The remaining anomalies include weak linear trends such as around **4193**, ridge and furrow, geological responses and small positive anomalies of possible archaeological interest.

### 3.6 Gradiometer Survey Results and Interpretation: Area A50

- 3.6.1 Field **A50 F01** (**Figures 83** to **85**) contains no anomalies of likely or probable archaeological significance. The only notable anomalies are some irregularly shaped positive anomalies within an area of superficial geology at **4195** and two ditch sections at **4196** and **4197**. The strong positives within **4195** may prove to be geological whereas the two linear features are most likely agricultural; as a result all three have been classed as possible archaeology. The remaining features include weak linear trends, spreads of increased magnetic response as at **4198**, a modern service at **4199** and a number of small positive anomalies of possible archaeological significance.
- 3.6.2 Fields **A50 F02** and **F03** contain only one anomaly of probable archaeological significance at **4202**. This feature appears to be a sub-oval pit although it extends beyond the area covered with geophysical survey and may therefore be part of a larger feature. The centre of this anomaly is irregular in shape possessing the highest values (over +3nT), this area



is surrounded by weaker values around +2nT. This feature is interpreted as probable archaeology with the weaker regions classed as possible archaeology. The remaining anomalies include a spread of increased magnetic response at **4200**, which may be a possible track, a modern service at **4201** and spreads of increased magnetic response as at **4203**.

## 3.7 Gradiometer Survey Results and Interpretation: Modern Services

- 3.7.1 There are numerous services scattered throughout the data with the greatest concentration towards the east and northeast.
- 3.7.2 An anomaly consistent with that of a pipe is seen running through **A50** at **4199** and **4201**. Another pipe, possibly the same service, appears in **A10** and **A8** at **4167** and **4022** and another similar pipe is visible further south in **A10R** at **4031** and **4037**. An offshoot or crossing service is visible in the very south of **A8 F01** extending to the east which also appears to be a pipe. It is not clear whether these scattered observations of services on a similar alignment join to form a single service but all are clearly pipes of similar dimensions within the data.
- 3.7.3 Another large service is visible running through areas **A5**, **A6** and **A7** at **4007**, **4009** and **4015**. This service appears to represent a cable that runs SSE towards Kegworth.
- 3.7.4 A number of other smaller services have been observed throughout the rest of the data with several smaller pipes observed within A10R at 4026, 4028, 4030, 4038 and 4040 and two pipes around Field Farm in A10 at 4133 and 4136. A couple of possible cables have been observed within A8 at 4023.
- 3.7.5 It is not clear from the geophysical data whether any of the services identified are in active use. It should also be noted that gradiometer survey may not detect all services present on Site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on Site.

### 4 CONCLUSION

- 4.1.1 The detailed gradiometer survey has been successful in detecting anomalies of likely, probable and possible archaeological interest within the Site, in addition to regions of increased magnetic response and several modern services.
- 4.1.2 There are several groups of enclosures spread throughout the survey areas. While it is possible to define some as clear settlement sites from the detection of buildings, such as the round houses detected in A10 F13 at 4101 and 4102, most are difficult to characterise. Some are aligned parallel to modern field boundaries such as in A10 F09 at 4079 to 4083 and this may suggest that they are relatively recent and served an agricultural function. It is not considered that all enclosures detected relate to human occupation as some may have formed stock enclosures. Some isolated ditch sections are present that do not clearly relate to the modern regime of land division. It is possible that these ditches represent remnants of earlier field systems.
- 4.1.3 Two blocks of buildings/structures and connecting roads presumed to be associated with RAF Castle Donington were identified in **A10 F06** and **A10 F10** at **4058**, **4059** and **4085**-**4091**. The features are not recorded on wartime Ordnance Survey (OS) maps but appear



on 1962-1963 OS maps as an area defined and divided by a series of earthworks linked by roads/tracks. These areas appear to resemble dispersal pens that were designed to protect aircraft from bomb damage by spreading planes out over a wider area. The rectangular magnetic regions at **4087-4090** may represent areas of concrete that were flanked by earth banks on all four sides with roads connecting these structures. The roads in this area appear to follow the perimeter of the airfield.

- 4.1.4 The two possible Roman roads (MLE4636 & MLE4658) recorded as running through the Site were not detected as clearly defined anomalies in the geophysical data. This is perhaps due to the supposed routes running along existing field boundaries and tracks and they are possibly hidden by much stronger ferrous responses here. There is, however, a small area in the south of A10 where "King Street" (MLE4636) crosses the middle of fields A10 F22 and A10 F24 and nothing obvious is visible here. The only anomalies that roughly follow the line of the road are a group of parallel trends at 4130. The inability to detect a road in this area cannot be taken to be evidence of absence. The ability to detect a road depends on the materials used to build it; if industrial waste such as iron slag or waste ceramic material is used to metal the surface then it will be readily detectable through gradiometer survey but if local stone is used then the road may not be detected at all.
- 4.1.5 Area **A50** lies within an area recorded as the site of the Lockington barrow cemetery (MLE4687); no features were observed that could be considered to relate to ring ditches or barrows. No traces of the other recorded heritage assets highlighted in the DBA (CgMs, 2013) were found within the rest of the data.
- 4.1.6 Remnants of medieval and post-medieval use of this land were detected in the form of ridge and furrow. The fields identified from the data as containing these features roughly correspond to the recorded locations of known ridge and furrow in the area (CgMs, 2013).
- 4.1.7 The relative dimensions of the modern services identified by the gradiometer survey are indicative of the strength of their magnetic response, which is dependent upon the materials used in their construction and the backfill of the service trenches. The physical dimensions of the services indicated may therefore differ from their magnetic extents in plan; it is assumed that the centreline of services is coincident with the centreline of their anomalies, however. Similarly, it is difficult to estimate the depth of burial of the services through gradiometer survey.
- 4.1.8 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey. This is particularly true at this Site as some of the archaeology detected has had very weak magnetic values and have appeared to gradually fade into the background in places. This perhaps suggests there are many more ditch sections that are simply not detectable through gradiometer survey as their fills are largely composed of magnetically sterile soil. It should also be noted that while it is possible to detect cut features such as ditches through gradiometer survey it is not always possible to identify the footings of stone buildings where local rocks are used in construction.



#### 5 REFERENCES

## 5.1 Bibliography

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English Heritage, 2008: *Geophysical Survey in Archaeological Field Evaluation. Research and Professional Service Guideline* No 1, 2nd edition.

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# 5.2 Cartographic Sources

British Geological Survey

http://www.bgs.ac.uk/discoveringgeology/geologyofbritain/viewer.html

Soil Survey of England and Wales (SSEW), 1983: Sheet 3, Soils of Midland and Western England. Ordnance Survey: Southampton.

Ordnance Survey, 1972. Leicestershire 1:10000

Ordnance Survey, 1962-1963. Derbyshire 1:2500

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Ordnance Survey, 1921-1922. Leicestershire 1:10560

#### 5.3 HER Records Consulted

MLE4636 - Possible Roman road, King Street

MLE4658 - Long Lane II, possible Roman road

MLE4678 - Medieval field system

MLE4682 - Possible cropmark enclosure

MLE4684 - Post-medieval windmill

MLE4687 – Lockington barrow cemetery

MLE15963 - Castle Donington airfield

MLE16135 - Midland railway, Derby to Weston & Trent



#### APPENDIX 1: SURVEY EQUIPMENT AND DATA PROCESSING

#### Survey Methods and Equipment

The magnetic data for this project was acquired using a Bartington 601-2 dual magnetic gradiometer system. This instrument has two sensor assemblies fixed horizontally 1m apart allowing two traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1m separation, and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.

The gradiometers have an effective resolution of 0.03nT over a ±100nT range, and measurements from each sensor are logged at intervals of 0.25m. All of the data are stored on an integrated data logger for subsequent post-processing and analysis.

Wessex Archaeology undertakes two types of magnetic surveys: scanning and detail. Both types depend upon the establishment of an accurate 20m or 30m Site grid, which is achieved using a Leica Viva RTK GNSS instrument and then extended using tapes. The Leica Viva system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined with a precision of 0.02m in real-time and therefore exceed the level of accuracy recommended by English Heritage (2008) for geophysical surveys.

Scanning surveys consist of recording data at 0.25m intervals along transects spaced 10m apart, acquiring a minimum of 80 data points per transect. Due to the relatively coarse transect interval, scanning surveys should only be expected to detect extended regions of archaeological anomalies, when there is a greater likelihood of distinguishing such responses from the background magnetic field.

The detailed surveys consist of  $20m \times 20m$  or  $30m \times 30m$  grids, and data are collected at 0.25m intervals along traverses spaced 1m apart. These strategies give 1600 or 3600 measurements per 20m or 30m grid respectively, and are the recommended methodologies for archaeological surveys of this type (EH, 2008).

Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.125m intervals along traverses spaced up to 0.25m apart, resulting in a maximum of 28800 readings per 30m grid, exceeding that recommended by English Heritage (2008) for characterisation surveys.



#### Post-Processing

The magnetic data collected during the detail survey are downloaded from the Bartington system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the GPS information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.

Typical data and image processing steps may include:

- Destripe Applying a zero mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;
- Destagger Shifting each traverse longitudinally by a number of readings. This corrects for operator errors and is used to enhance linear features;
- Despike Filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data)

Typical displays of the data used during processing and analysis:

- XY Plot Presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This type of image is useful as it shows the full range of individual anomalies.
- Greyscale Presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.



#### **APPENDIX 2: GEOPHYSICAL INTERPRETATION**

The interpretation methodology used by Wessex Archaeology separates the anomalies into four main categories: archaeological, modern, agricultural and uncertain origin/geological.

The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further subdivided into three groups, implying a decreasing level of confidence:

- Archaeology used when there is a clear geophysical response and anthropogenic pattern.
- Probable archaeology used for features which give a clear response but which form incomplete patterns.
- Possible archaeology used for features which give a response but which form no discernible pattern or trend.

The modern category is used for anomalies that are presumed to be relatively modern in date:

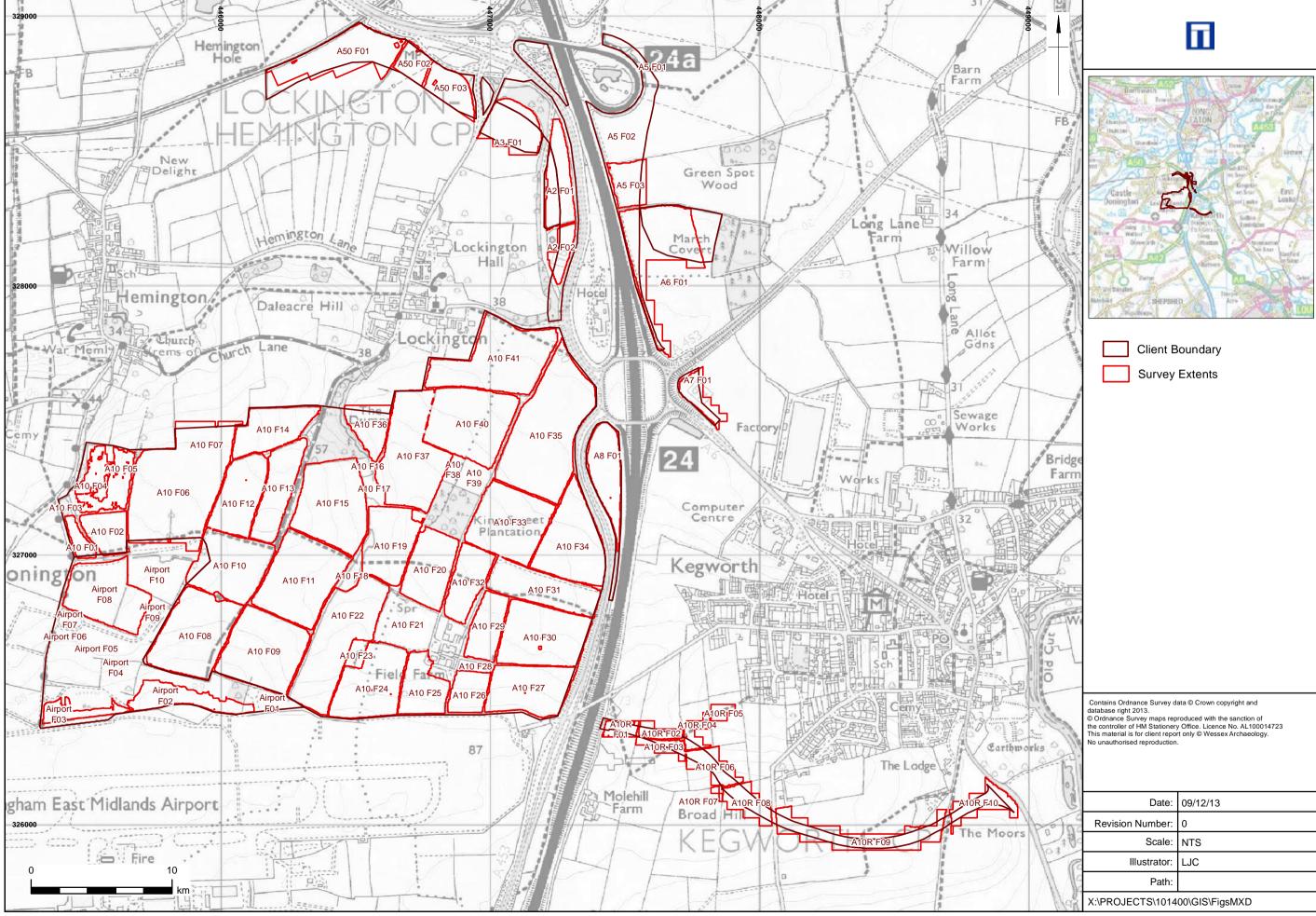
- Ferrous used for responses caused by ferrous material. These anomalies are likely to be of modern origin.
- Modern service used for responses considered relating to cables and pipes; most are composed of ferrous/ceramic material although services made from non-magnetic material can sometimes be observed.

The agricultural category is used for the following:

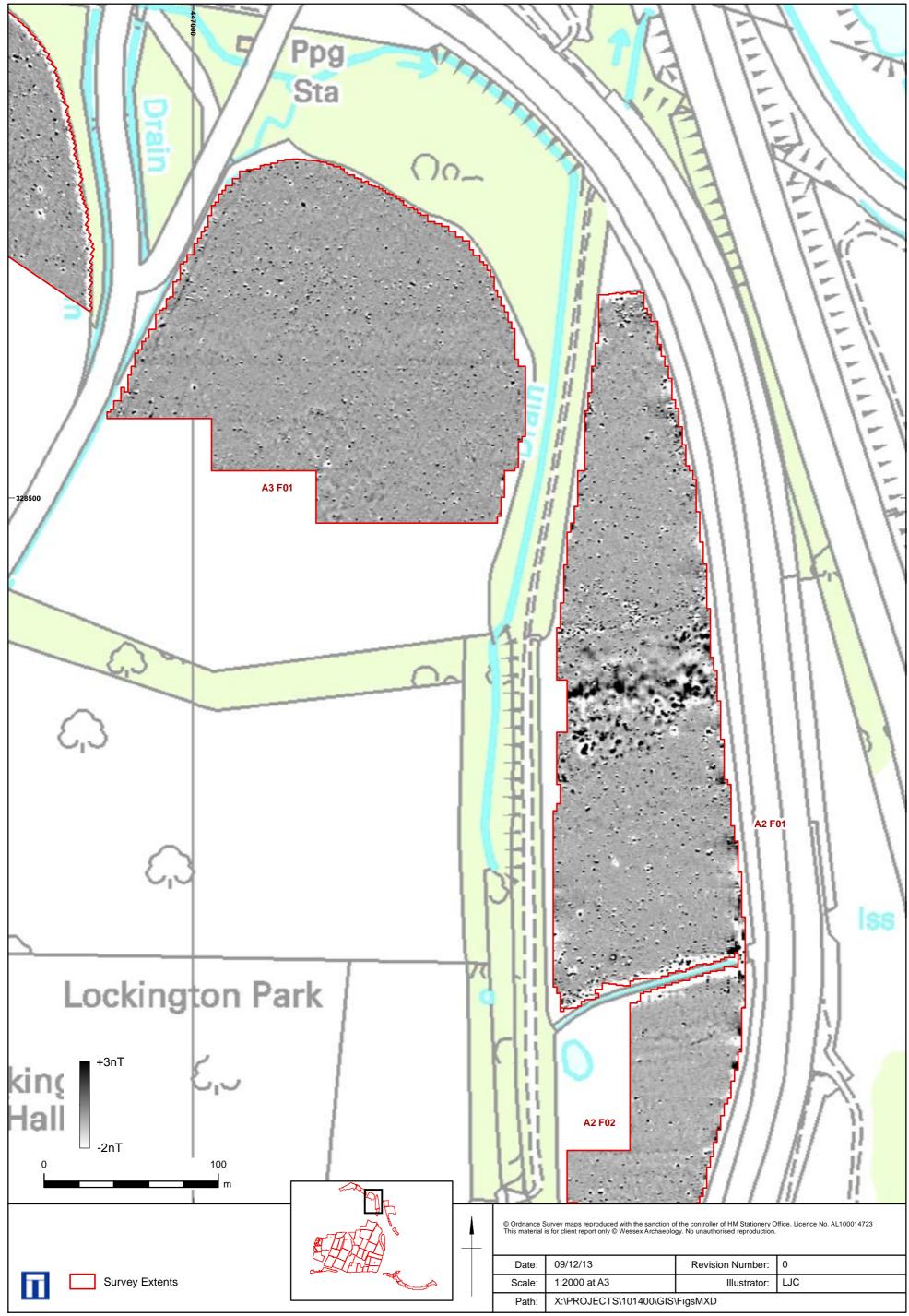
- Former field boundaries used for ditch sections that correspond to the position of boundaries marked on earlier mapping.
- Agricultural ditches used for ditch sections that are aligned parallel to existing boundaries and former field boundaries that are not considered to be of archaeological significance.
- Ridge and furrow used for broad and diffuse linear anomalies that are considered to indicate areas of former ridge and furrow.
- Ploughing used for well-defined narrow linear responses, usually aligned parallel to existing field boundaries.
- Drainage used to define the course of ceramic field drains that are visible in the data as a series of repeating bipolar (black and white) responses.

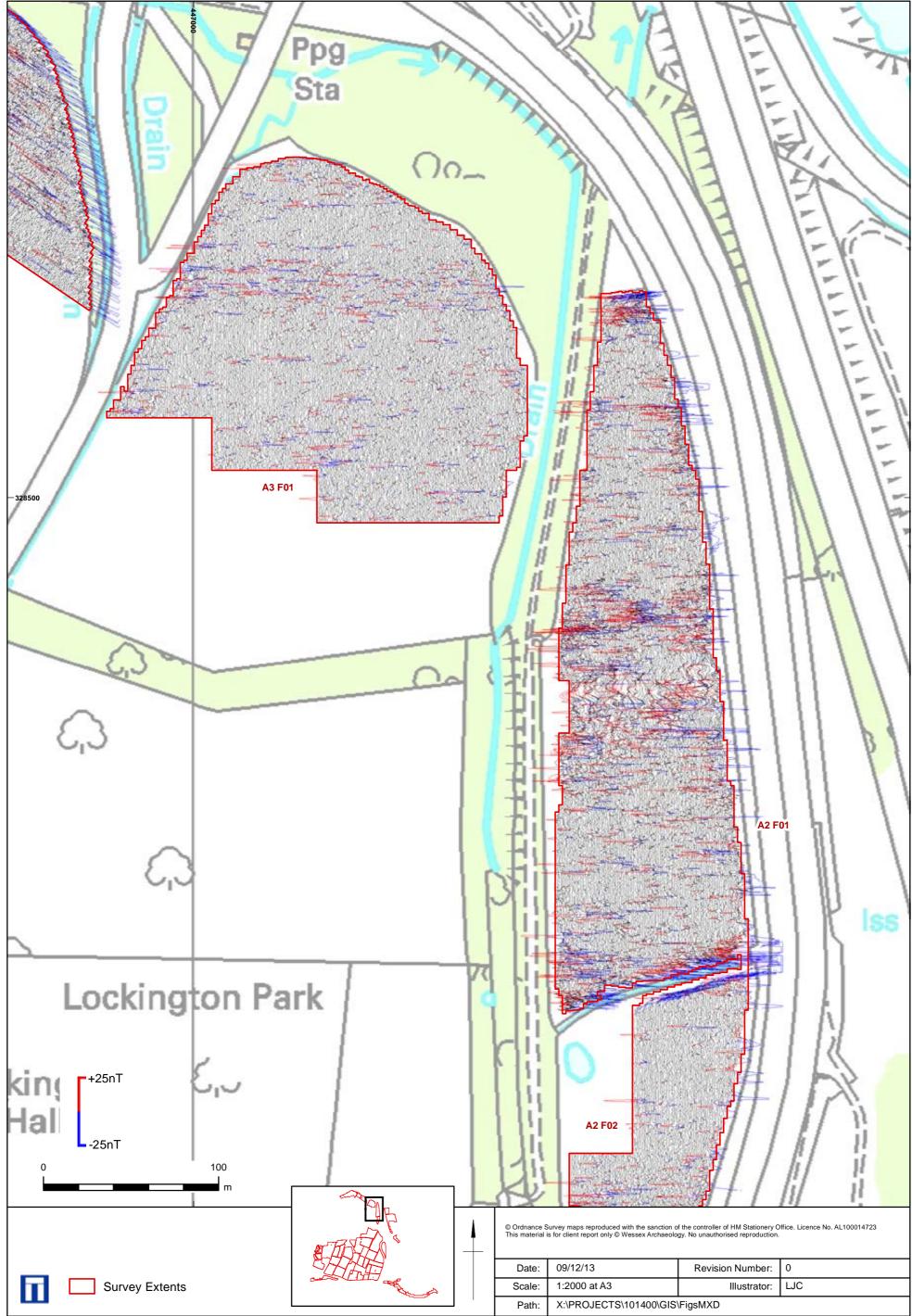
The uncertain origin/geological category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

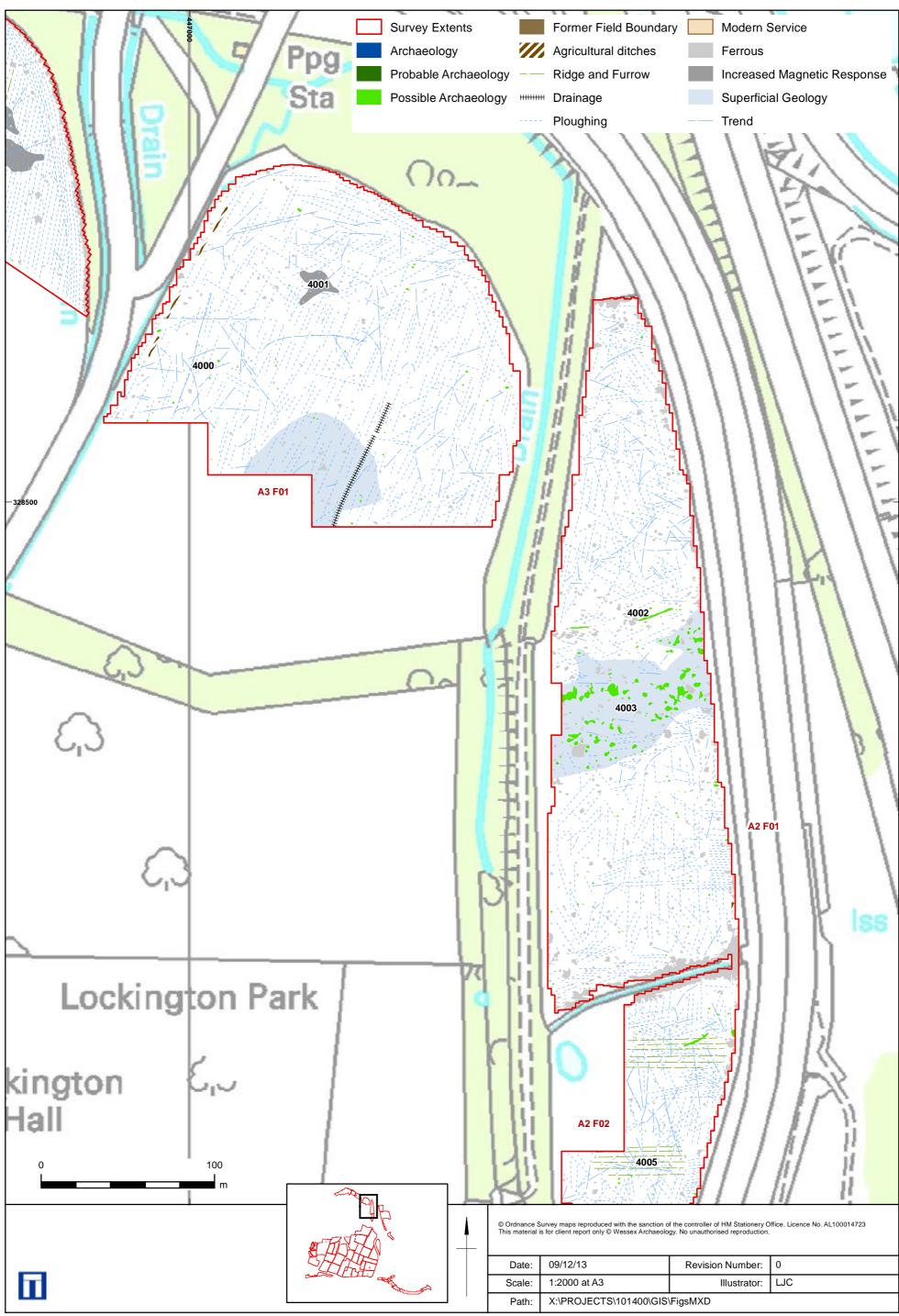
- Increased magnetic response used for areas dominated by indistinct anomalies which may have some archaeological potential.
- Trend used for low amplitude or indistinct linear anomalies.
- Superficial geology used for diffuse edged spreads considered to relate to shallow geological deposits. They can be distinguished as areas of positive, negative or broad bipolar (positive and negative) anomalies.

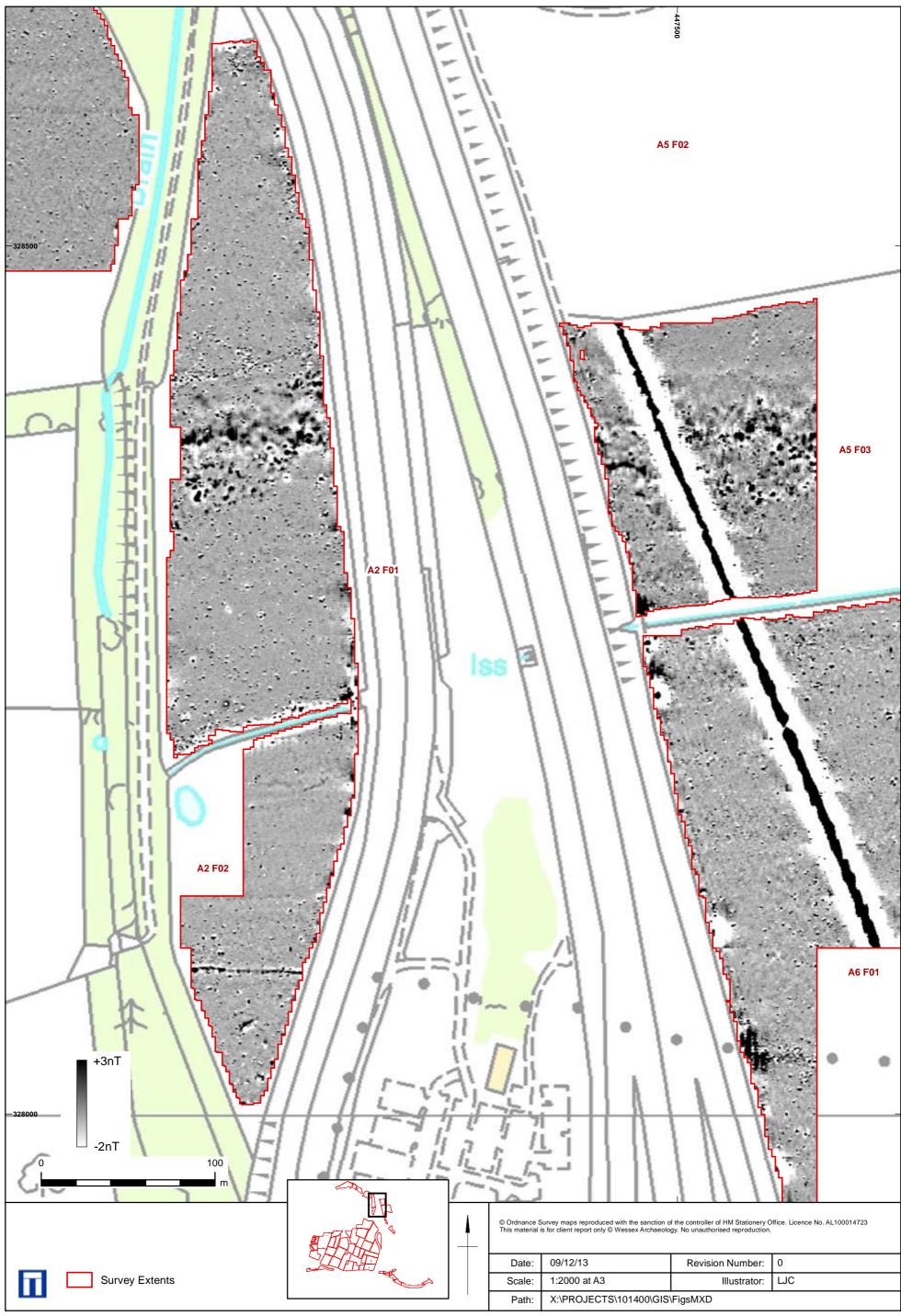


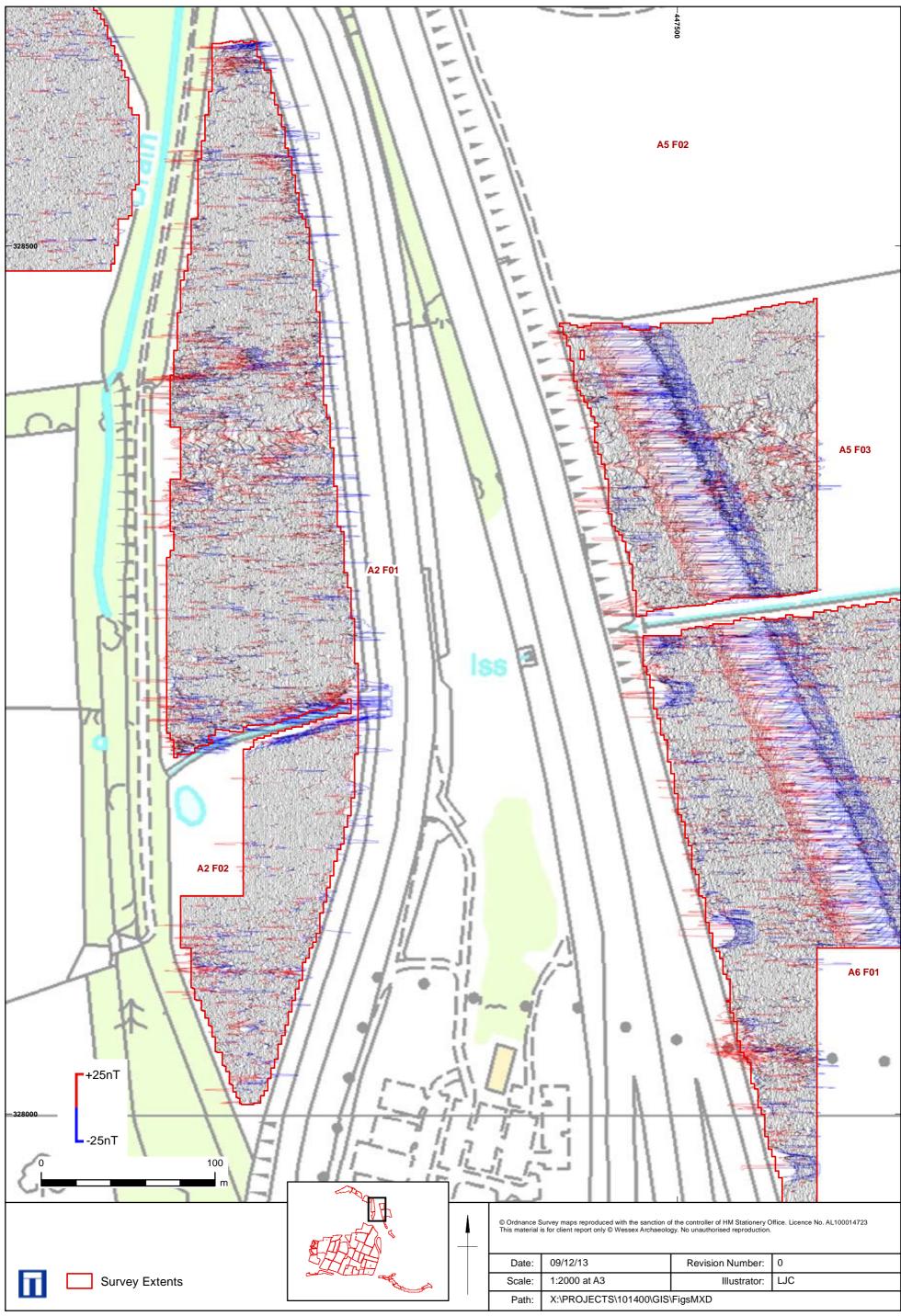
Site location plan

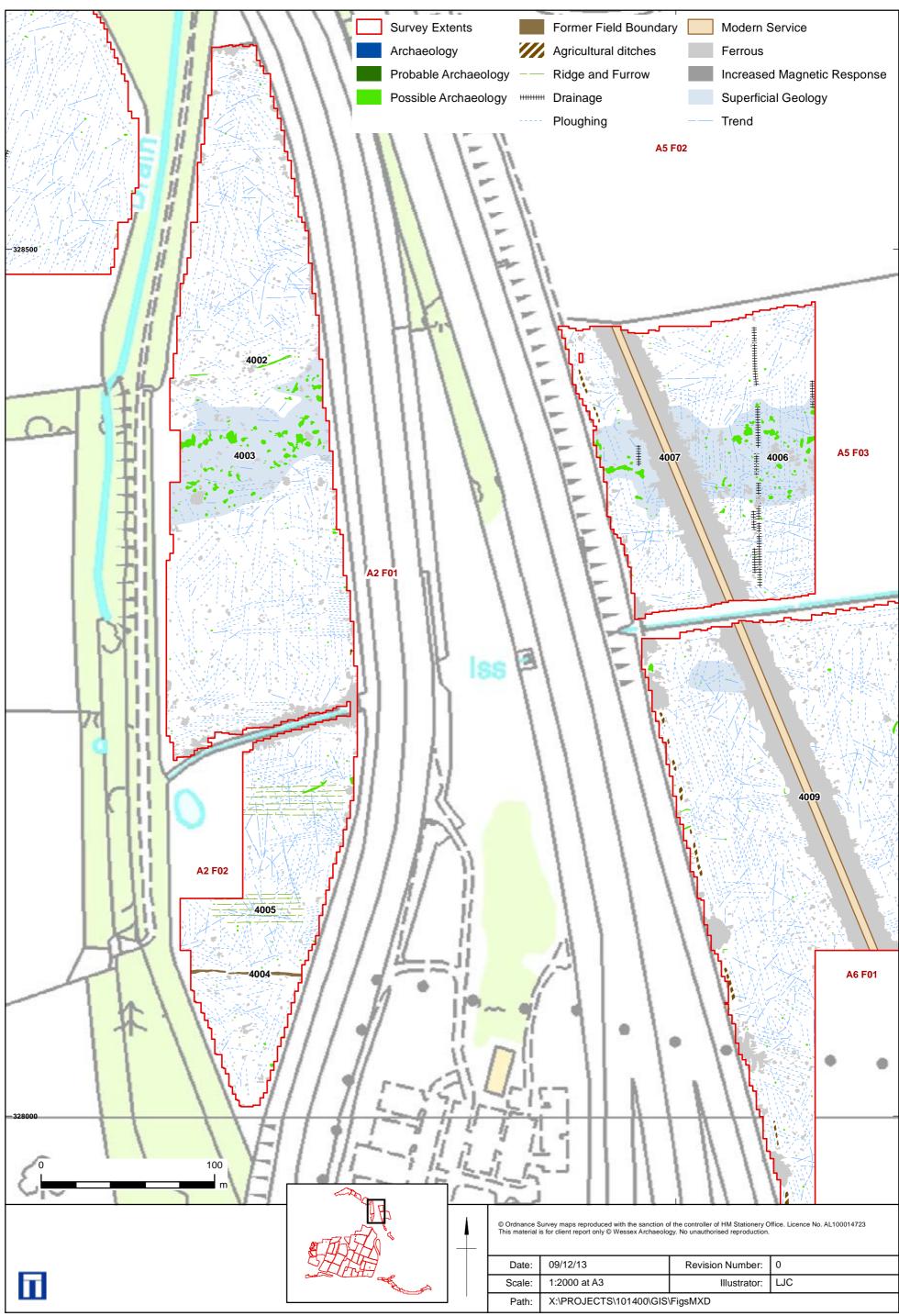


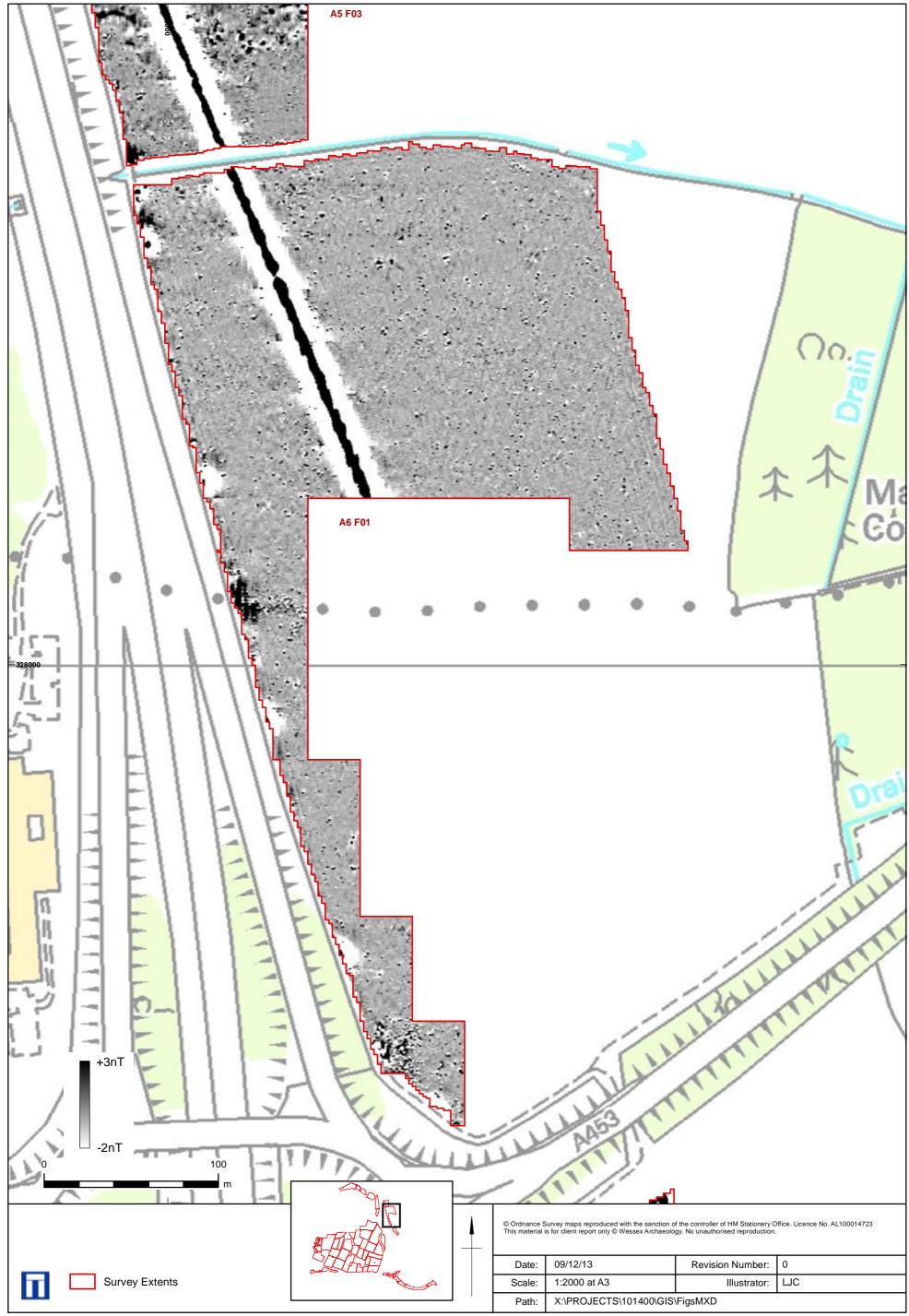




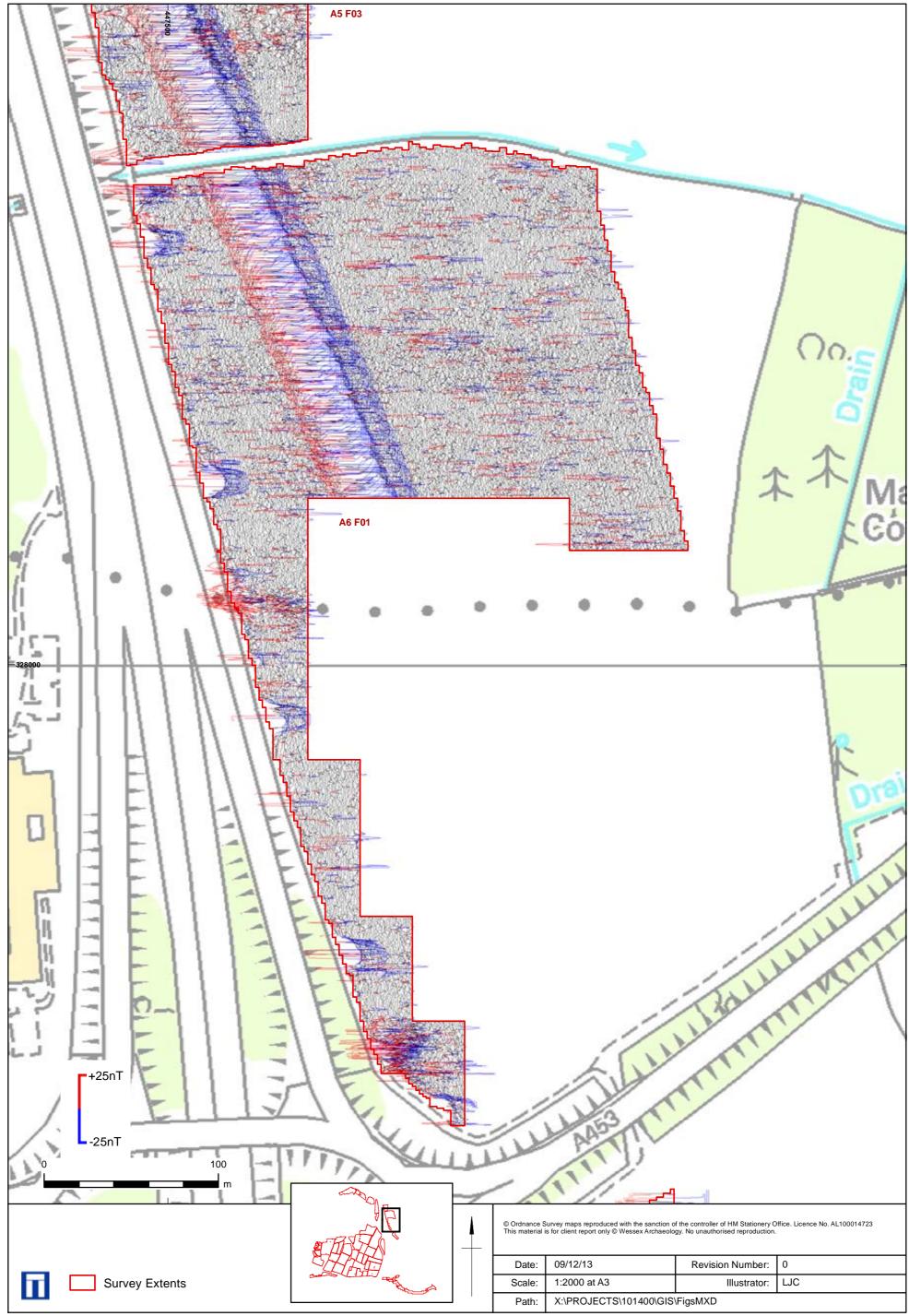


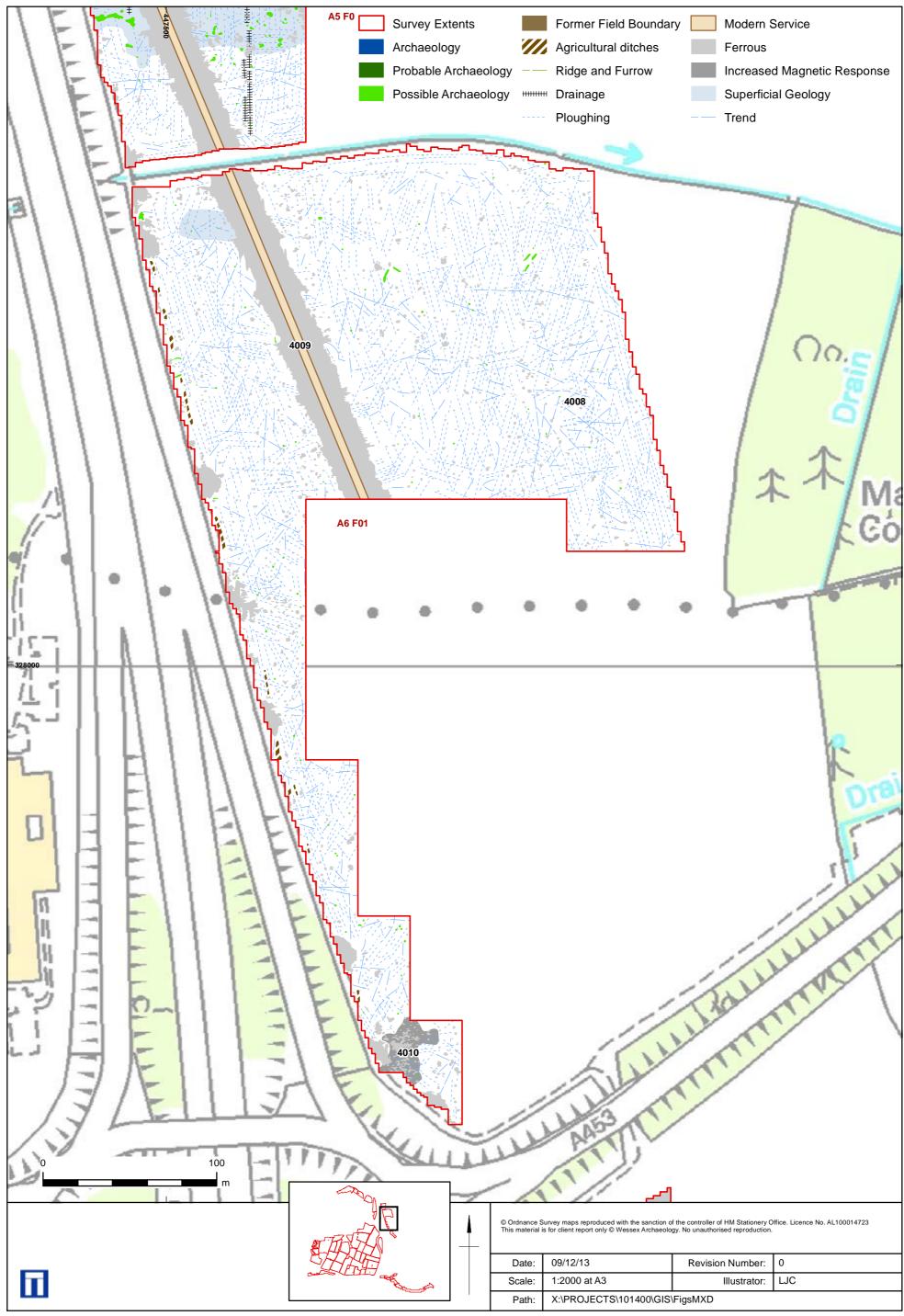


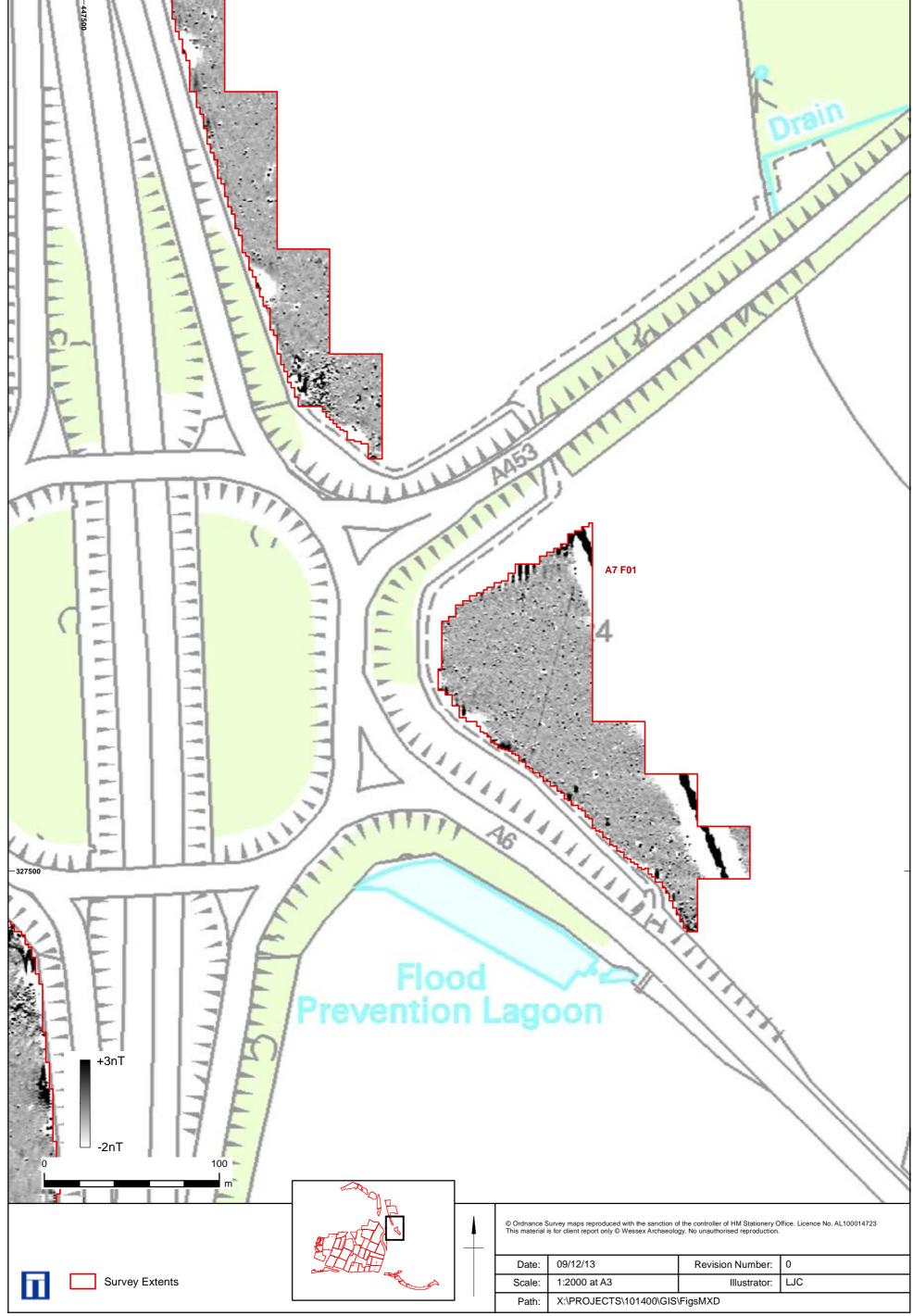




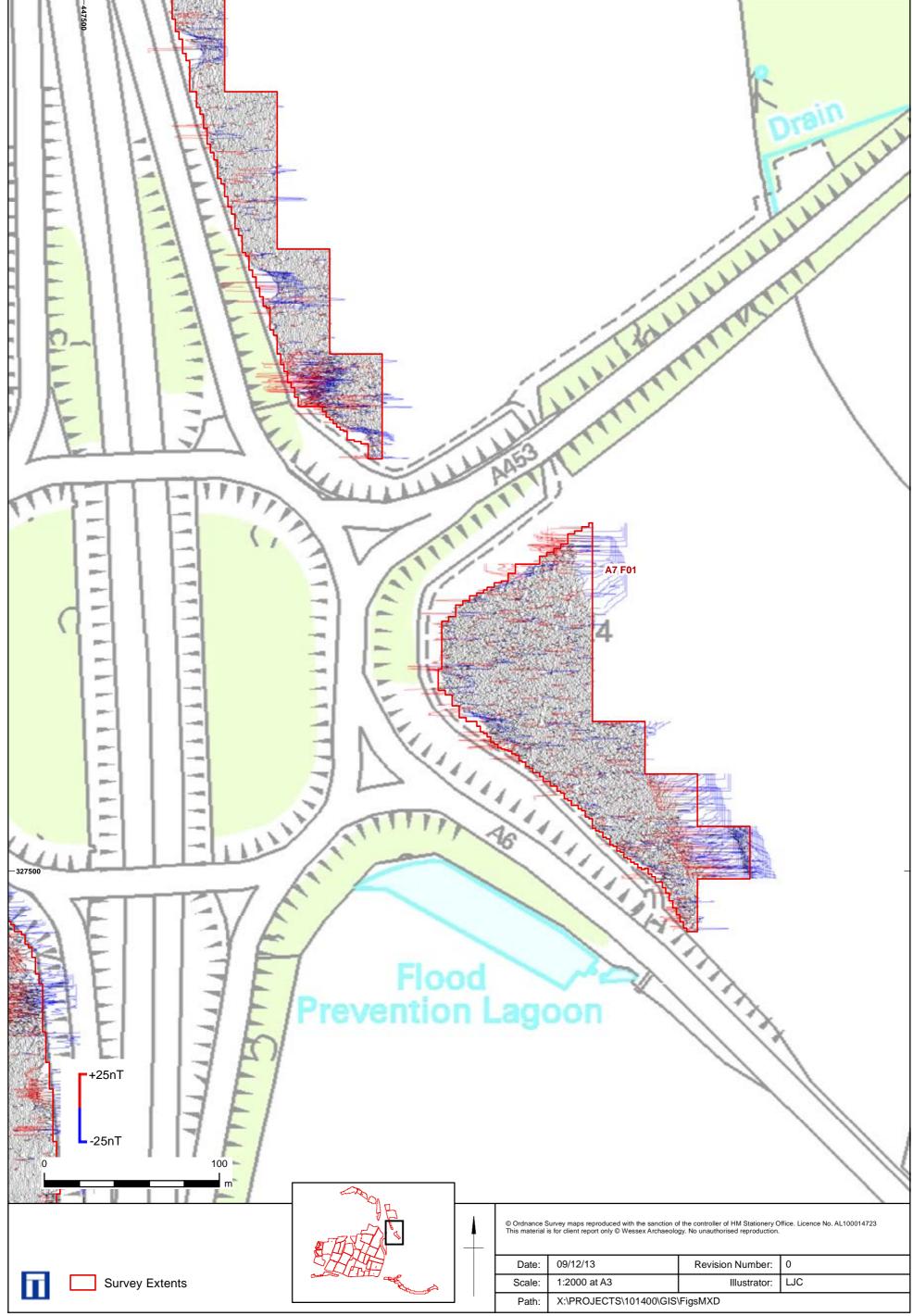
Greyscale: Fields A6 F01 Figure 8

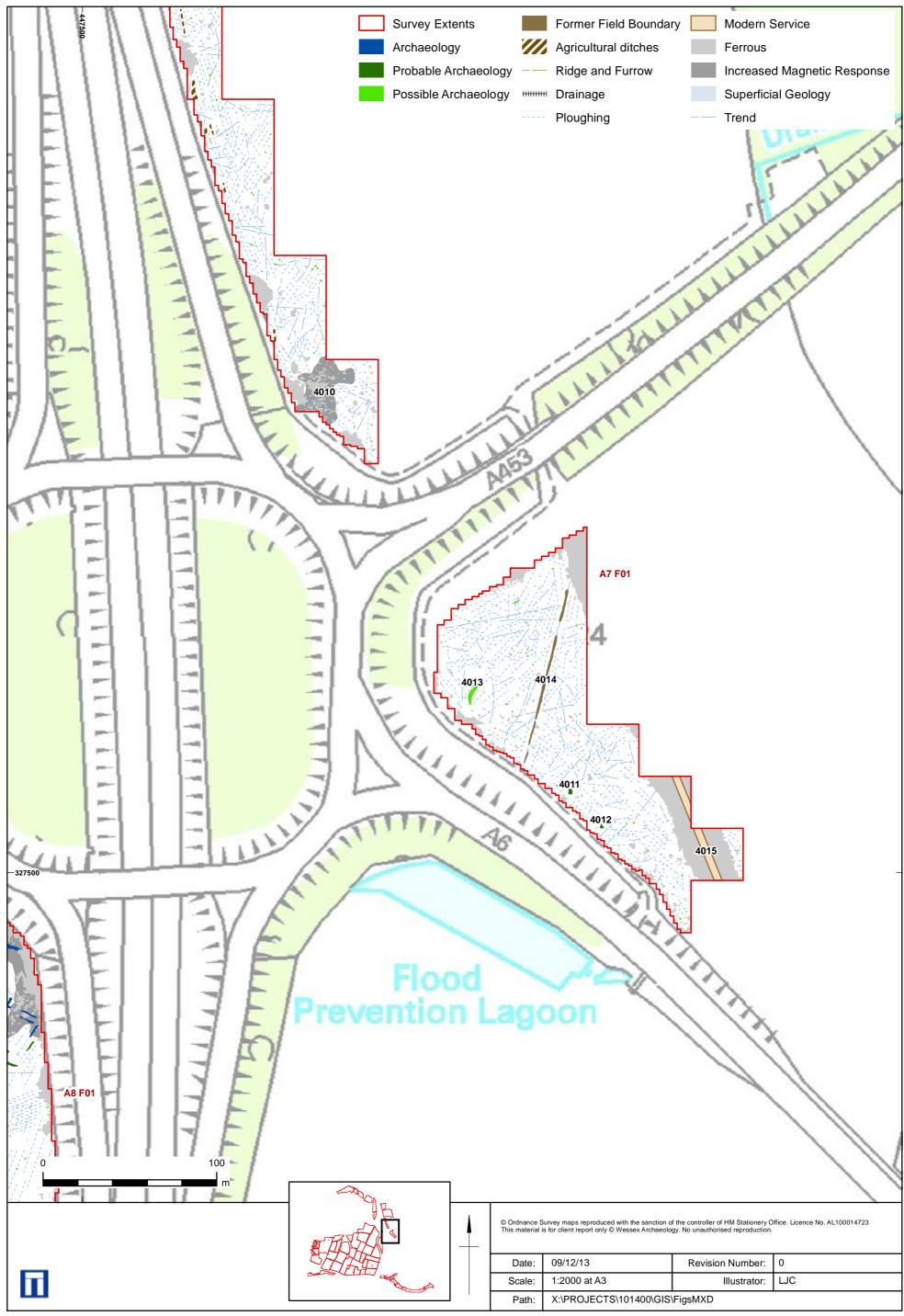


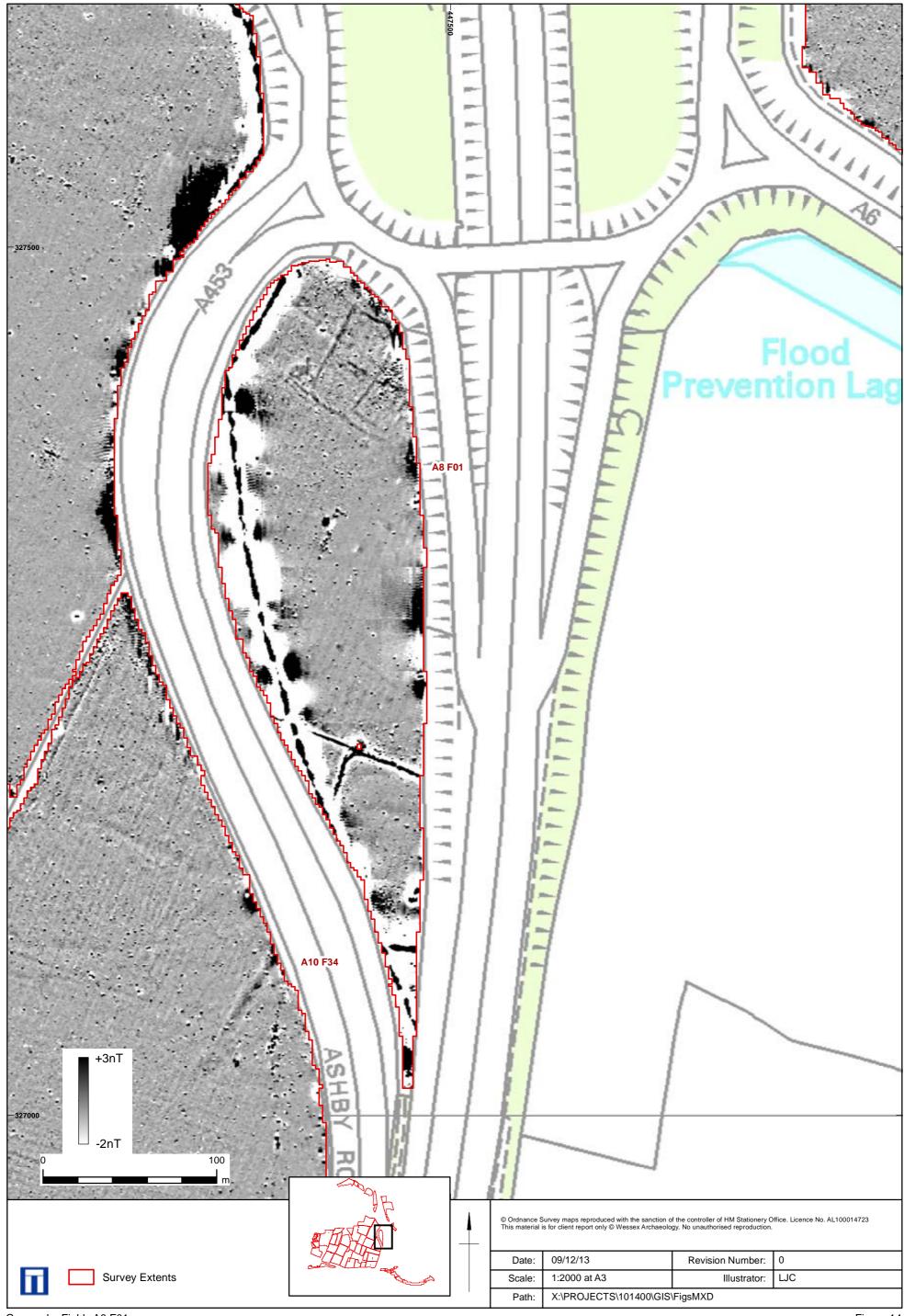


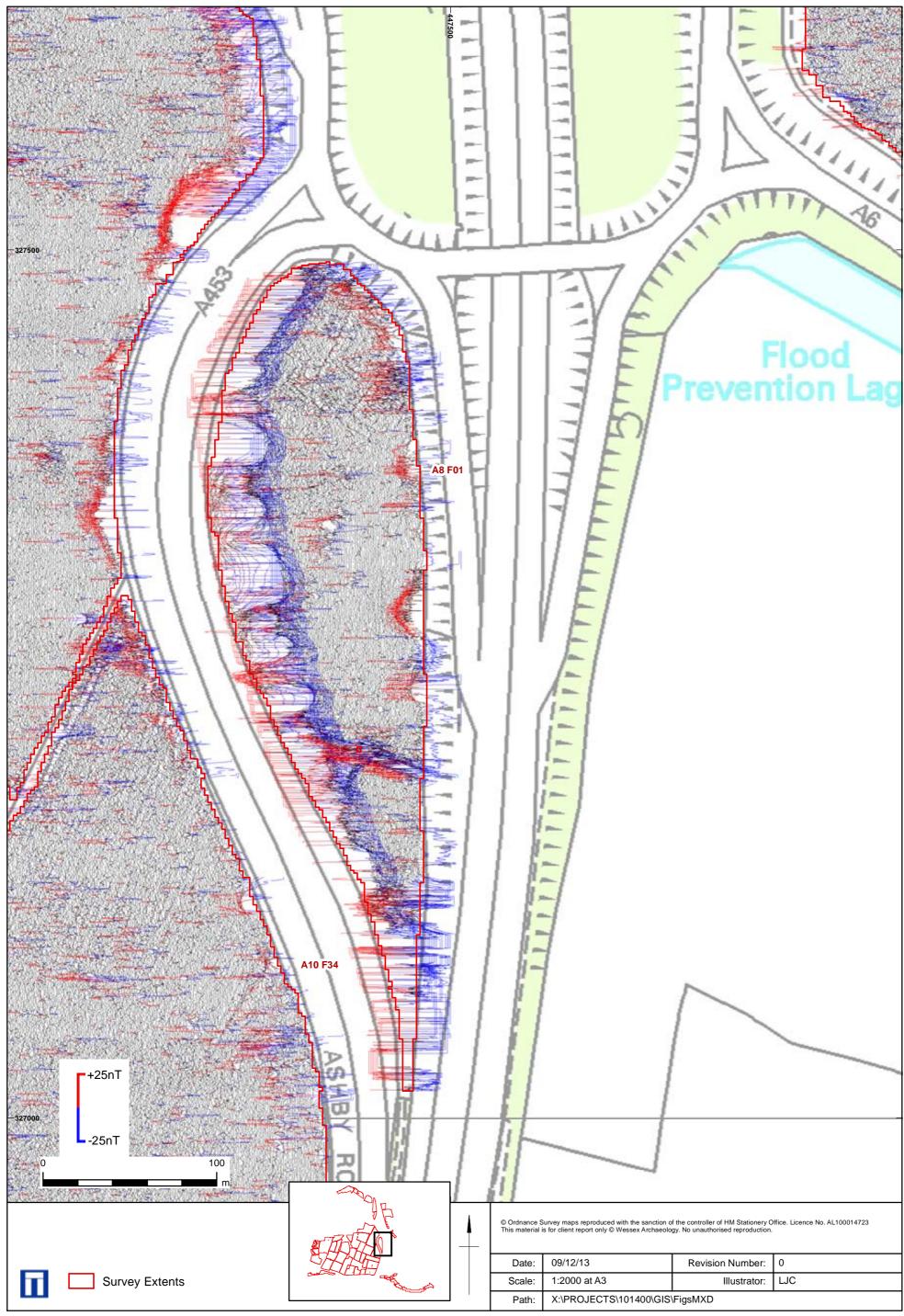


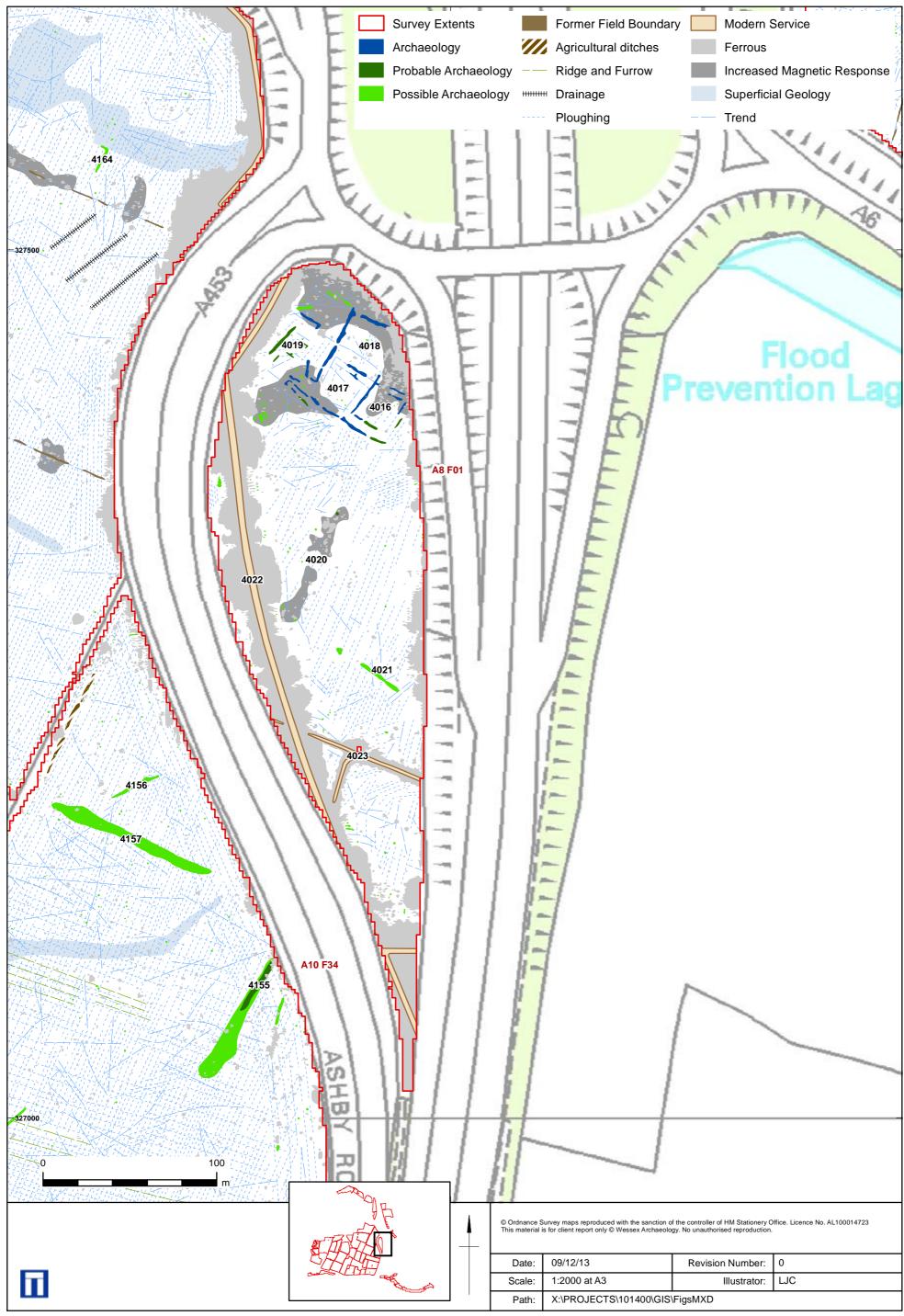
Greyscale: Fields A7 F01 Figure 11

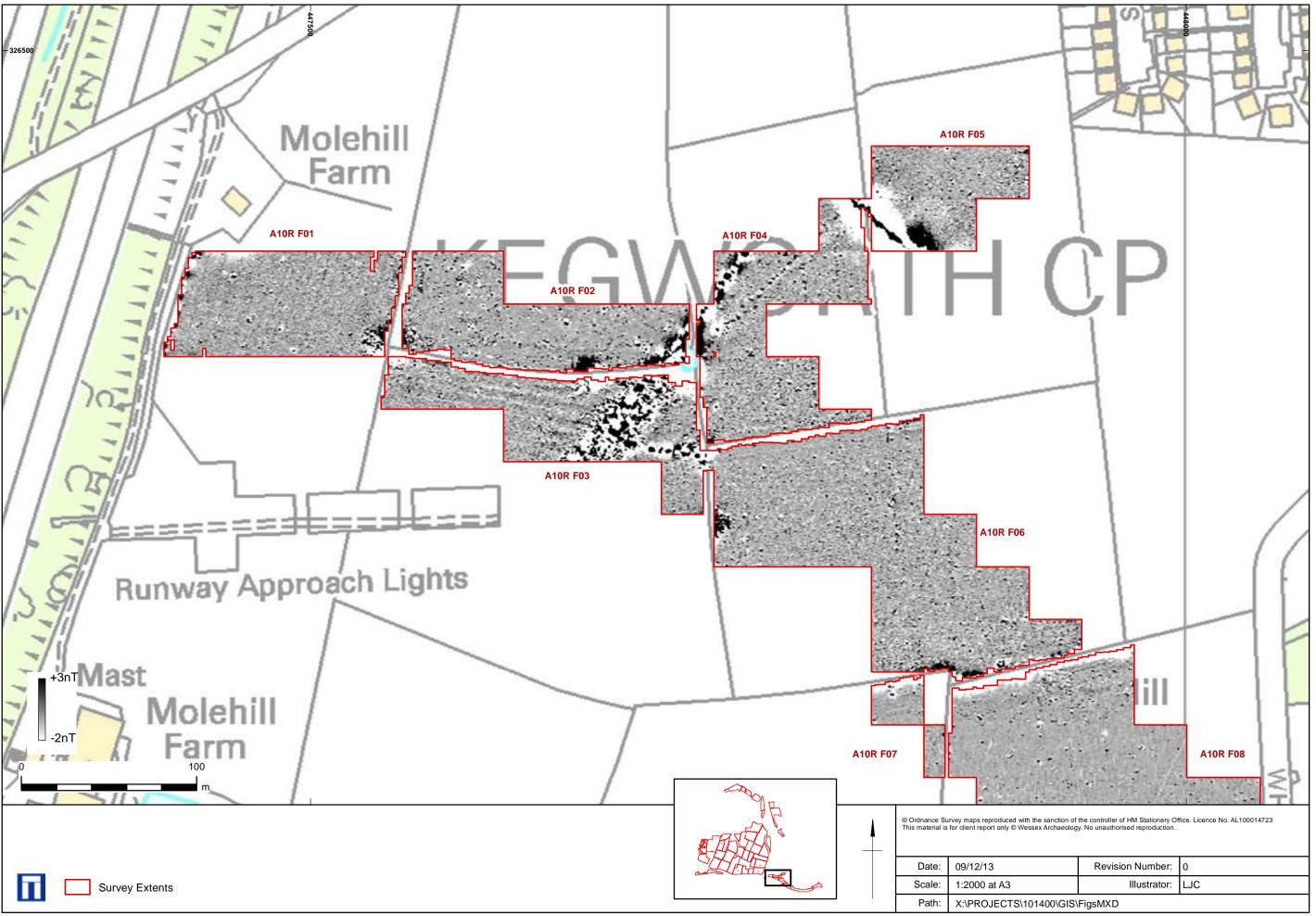


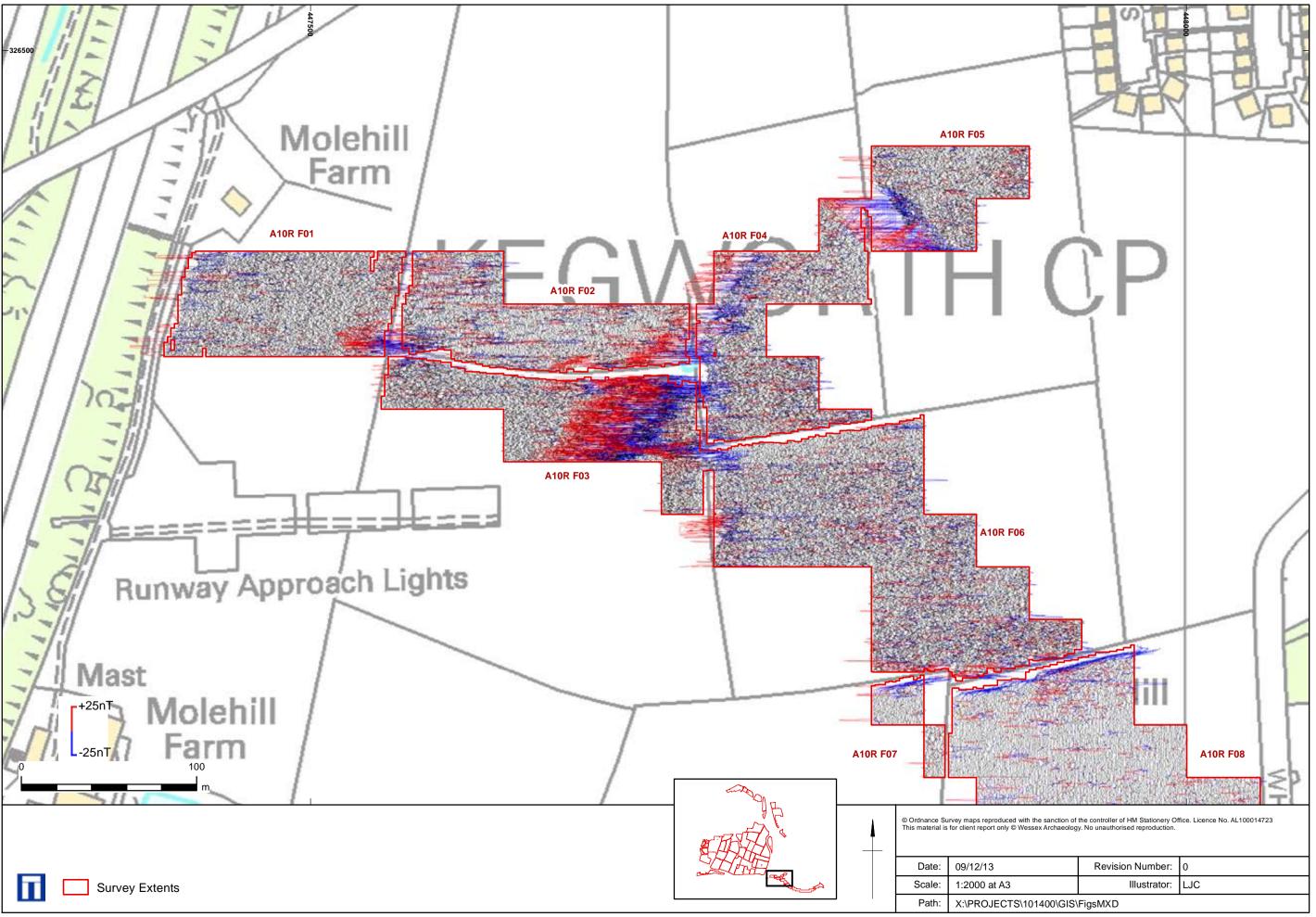


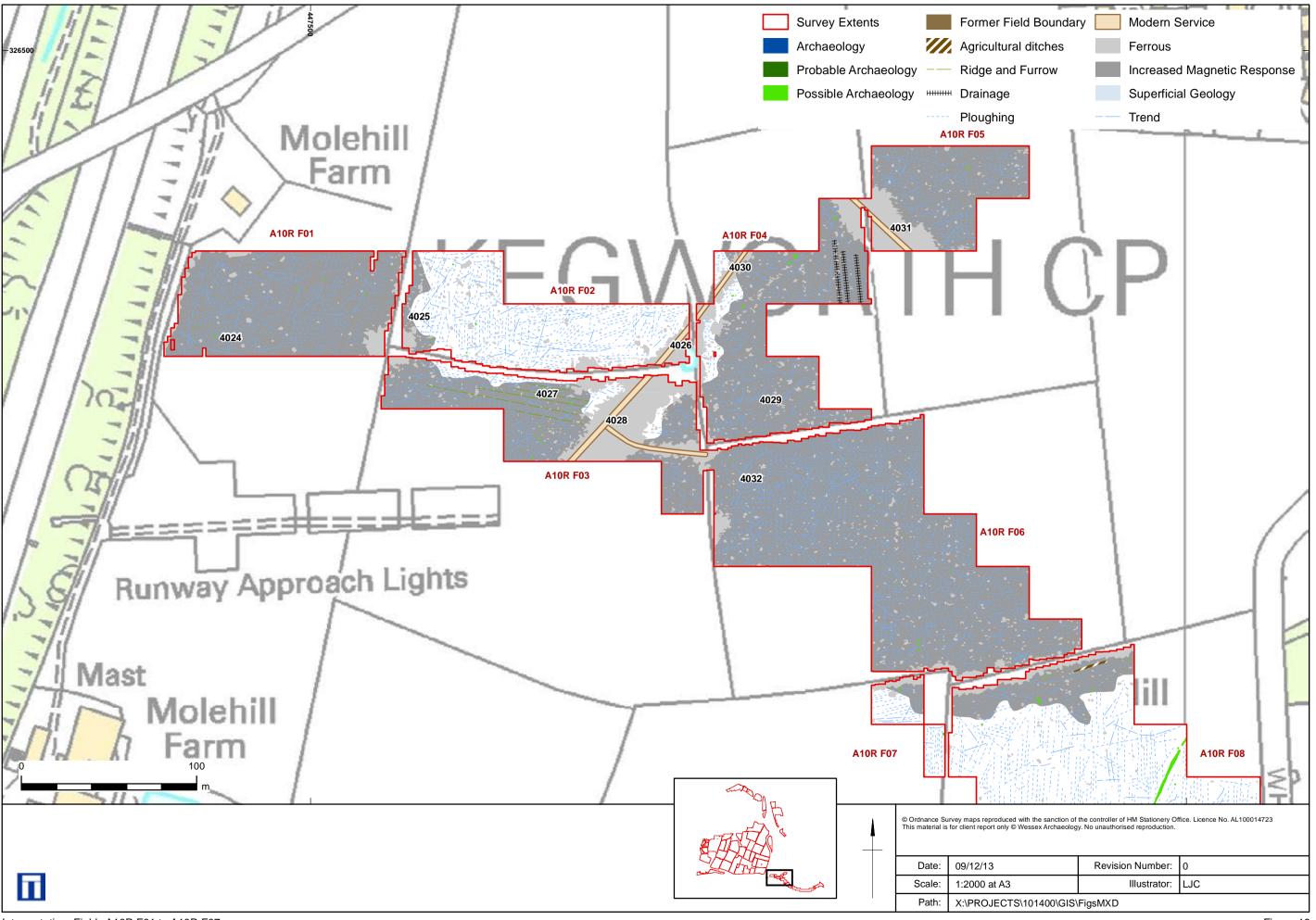


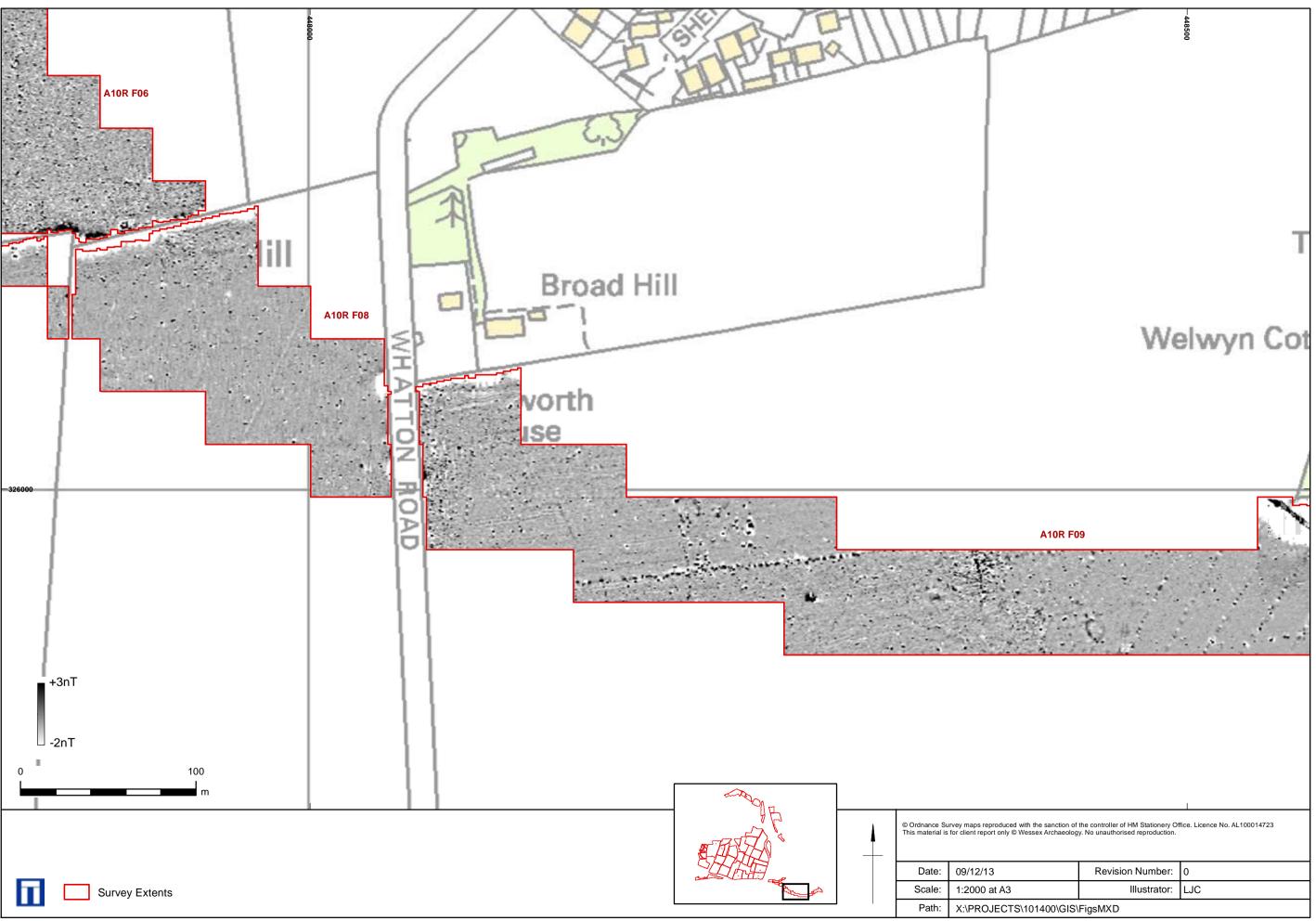


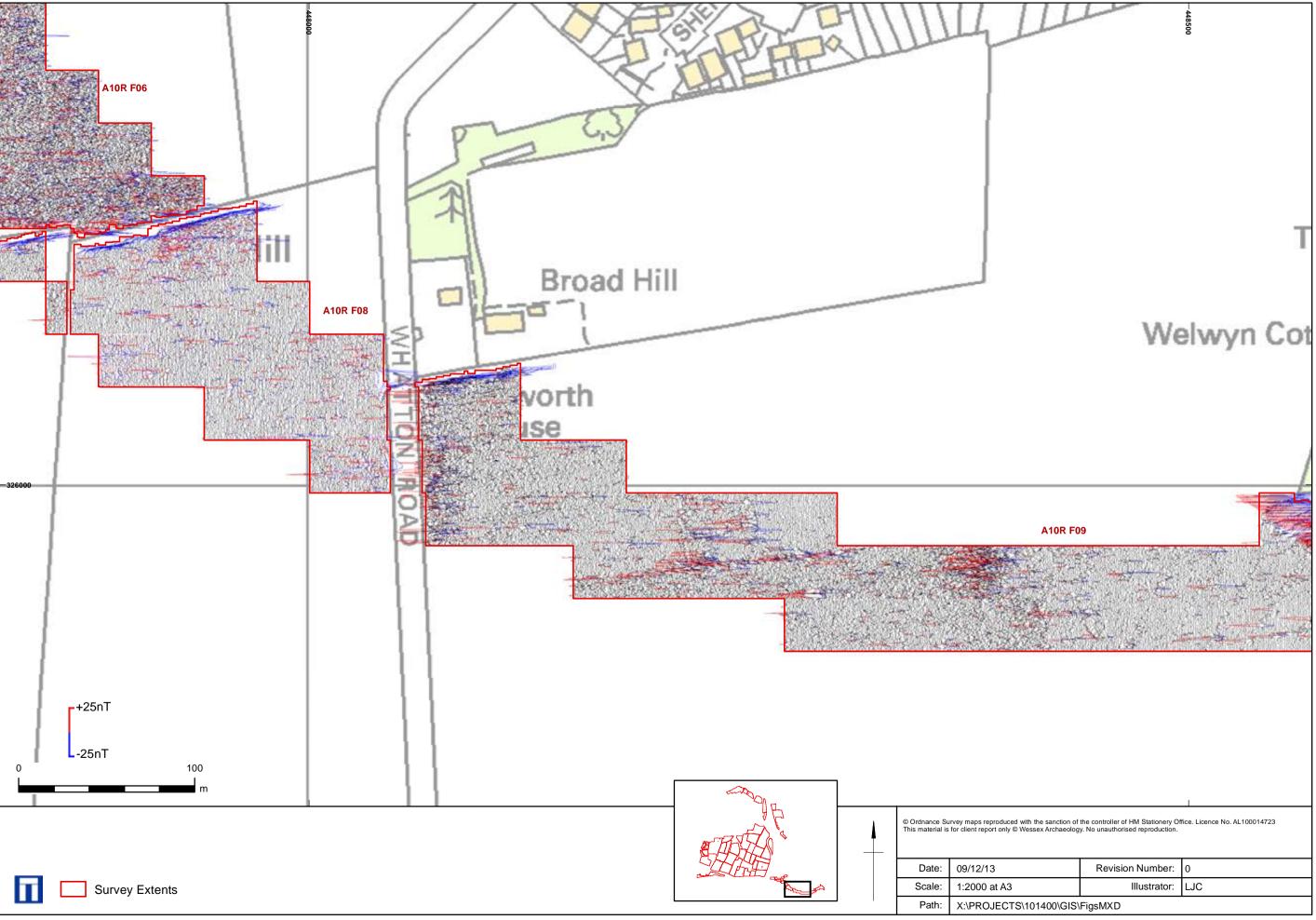


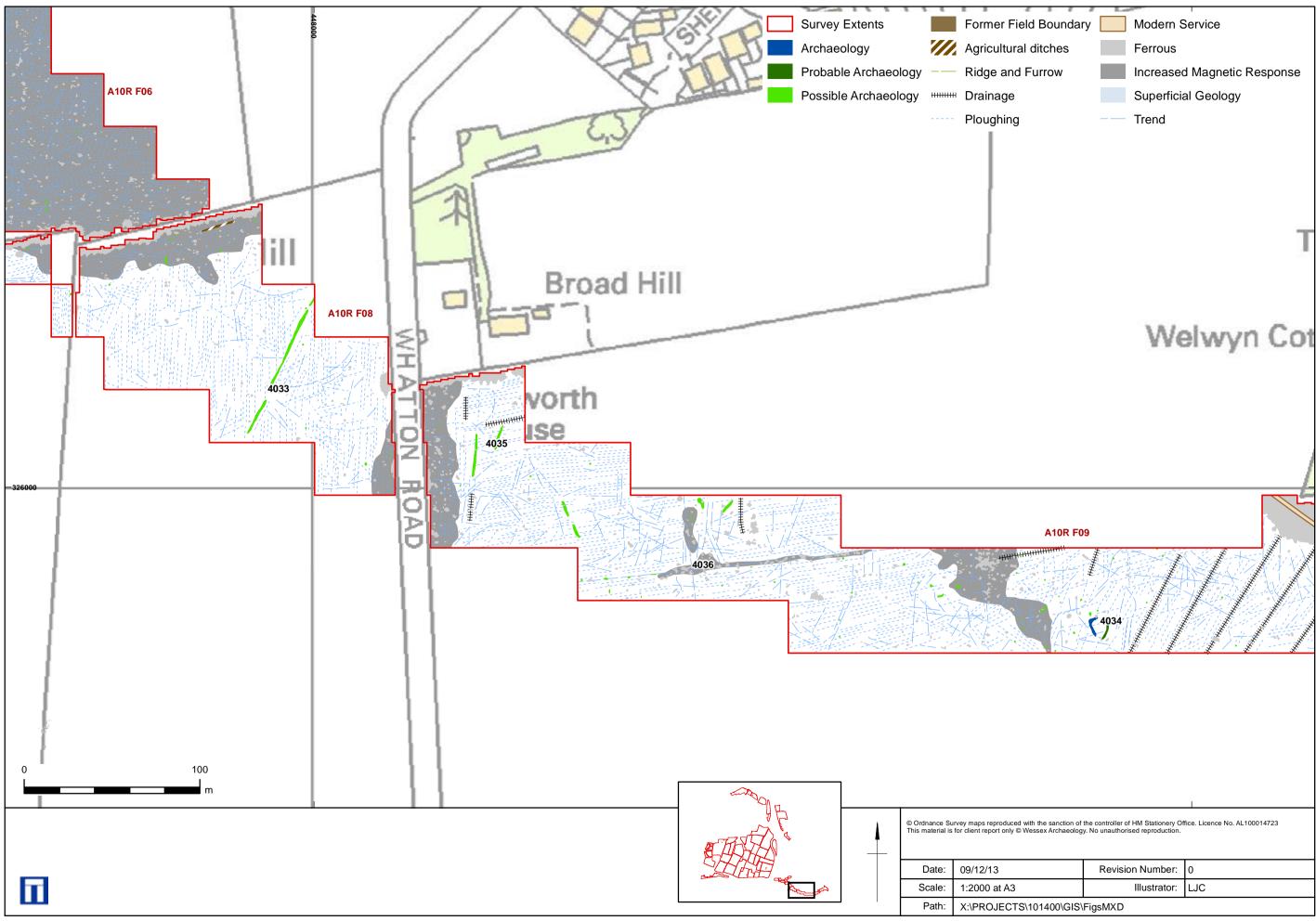


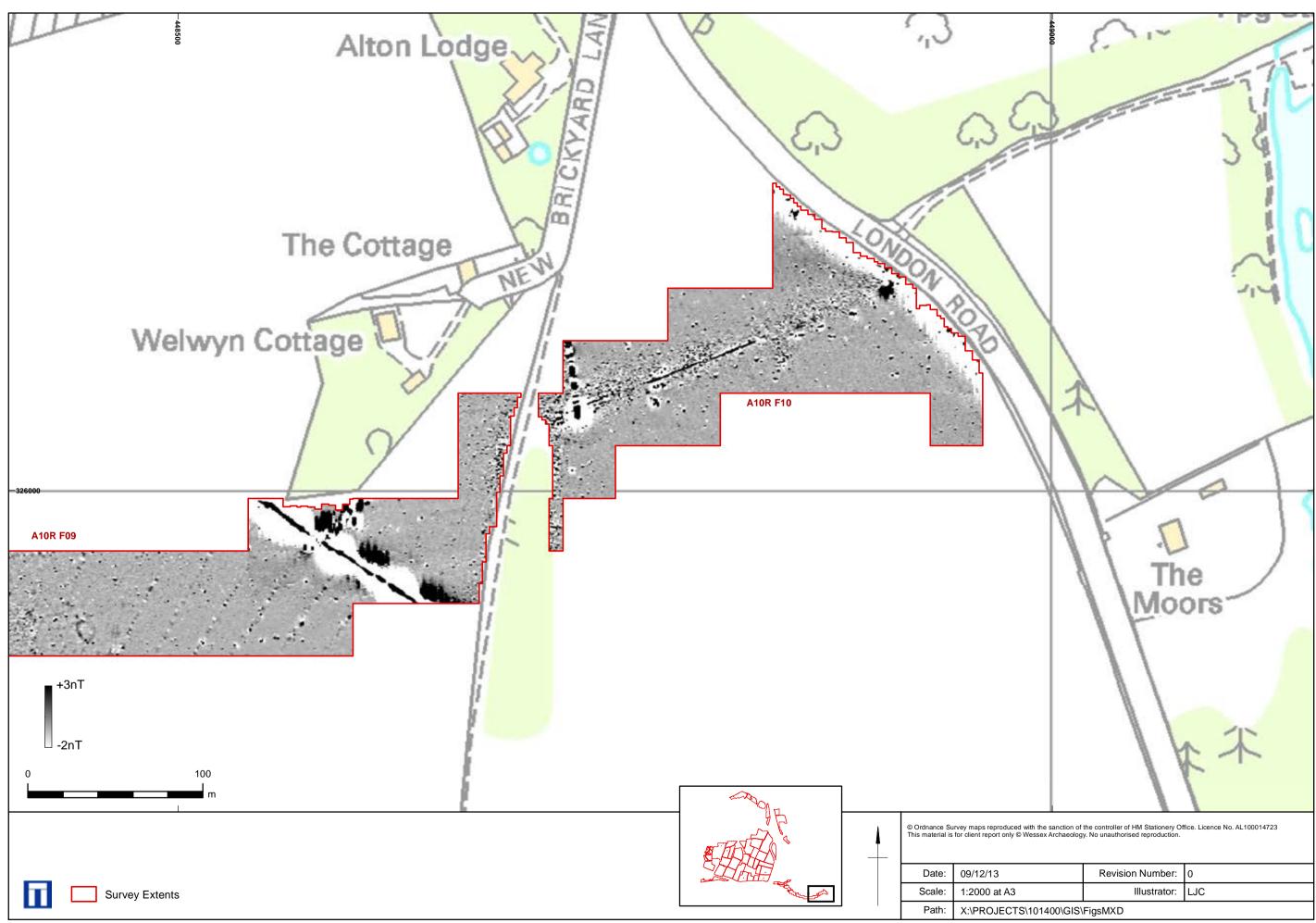


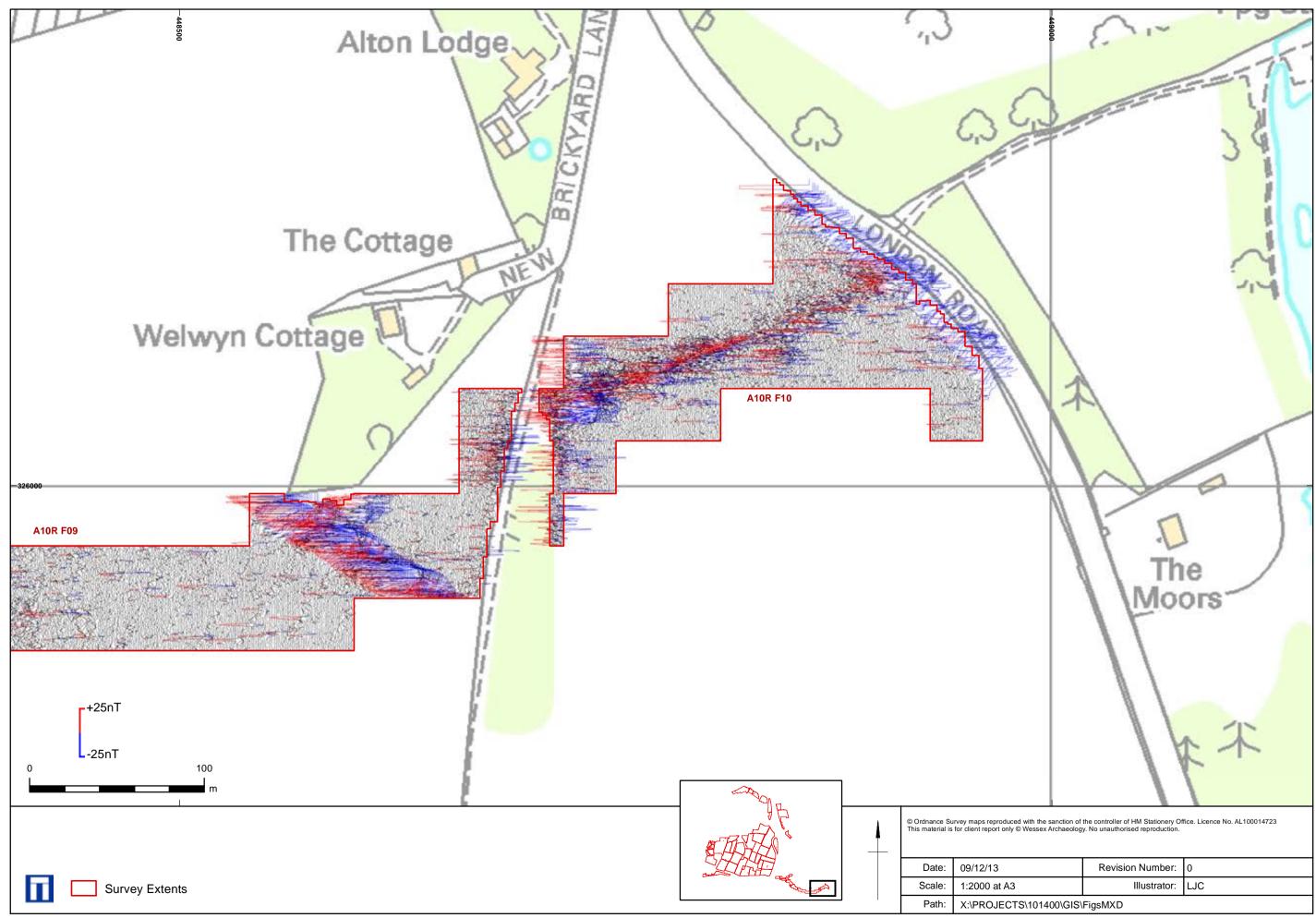


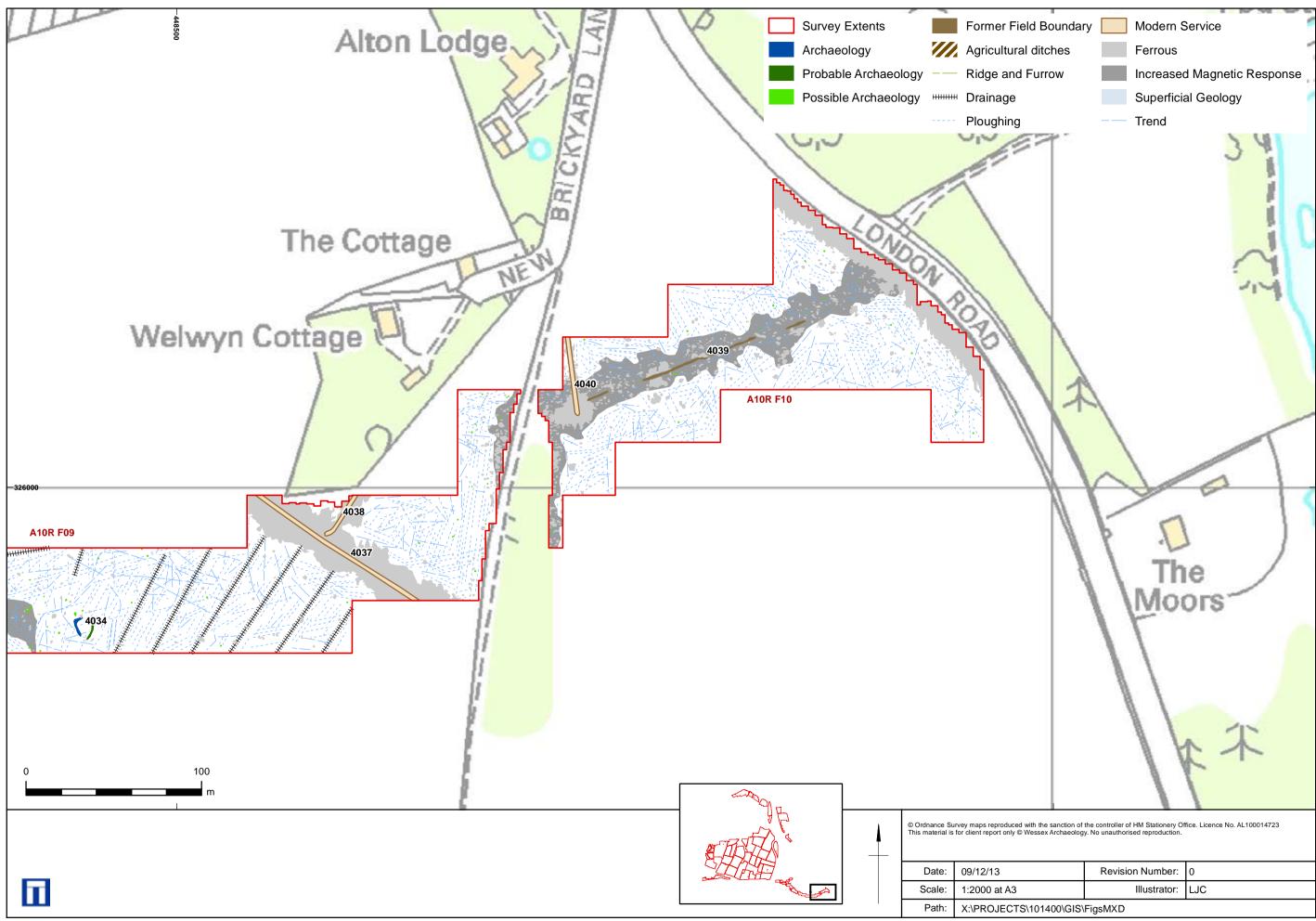


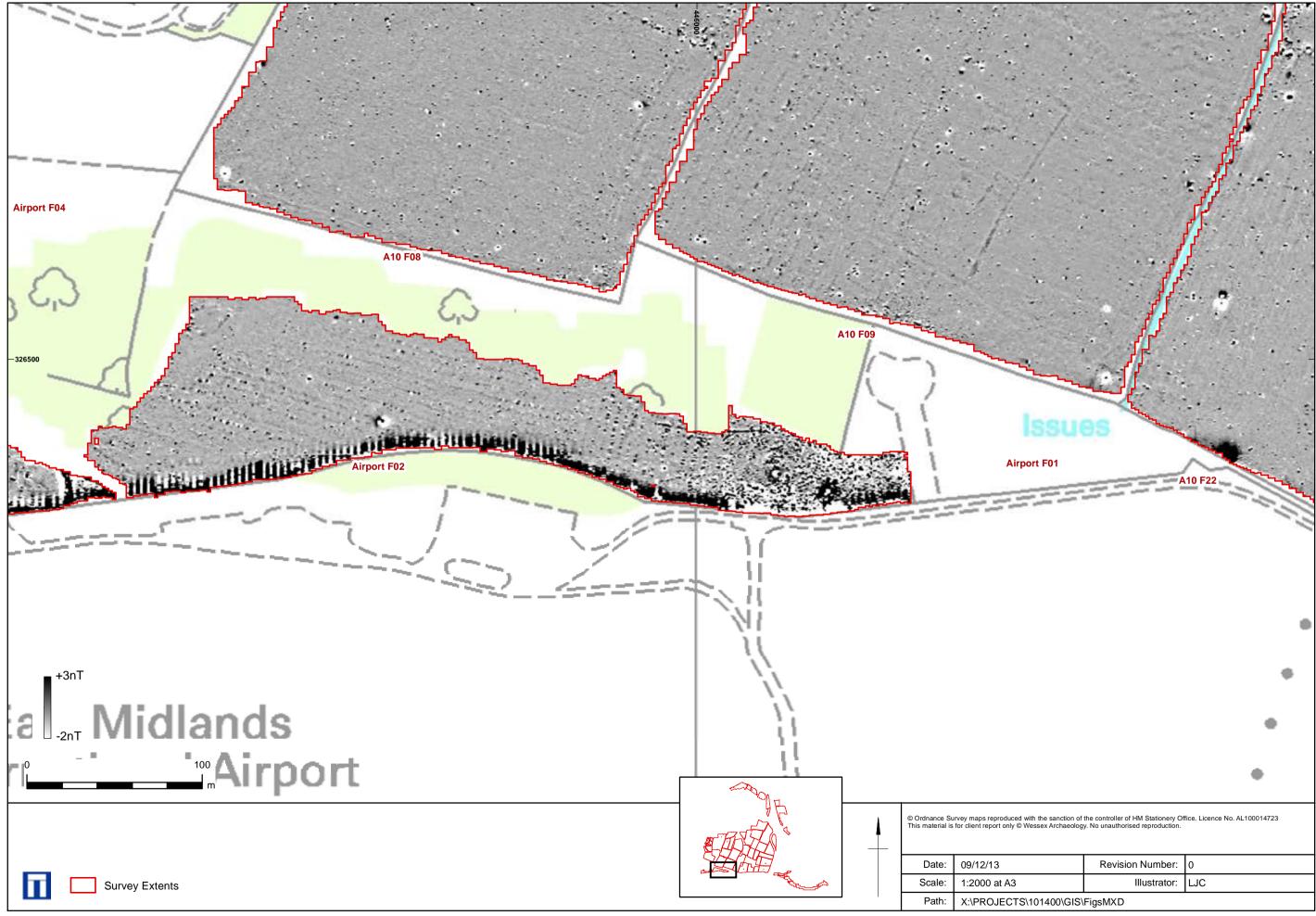


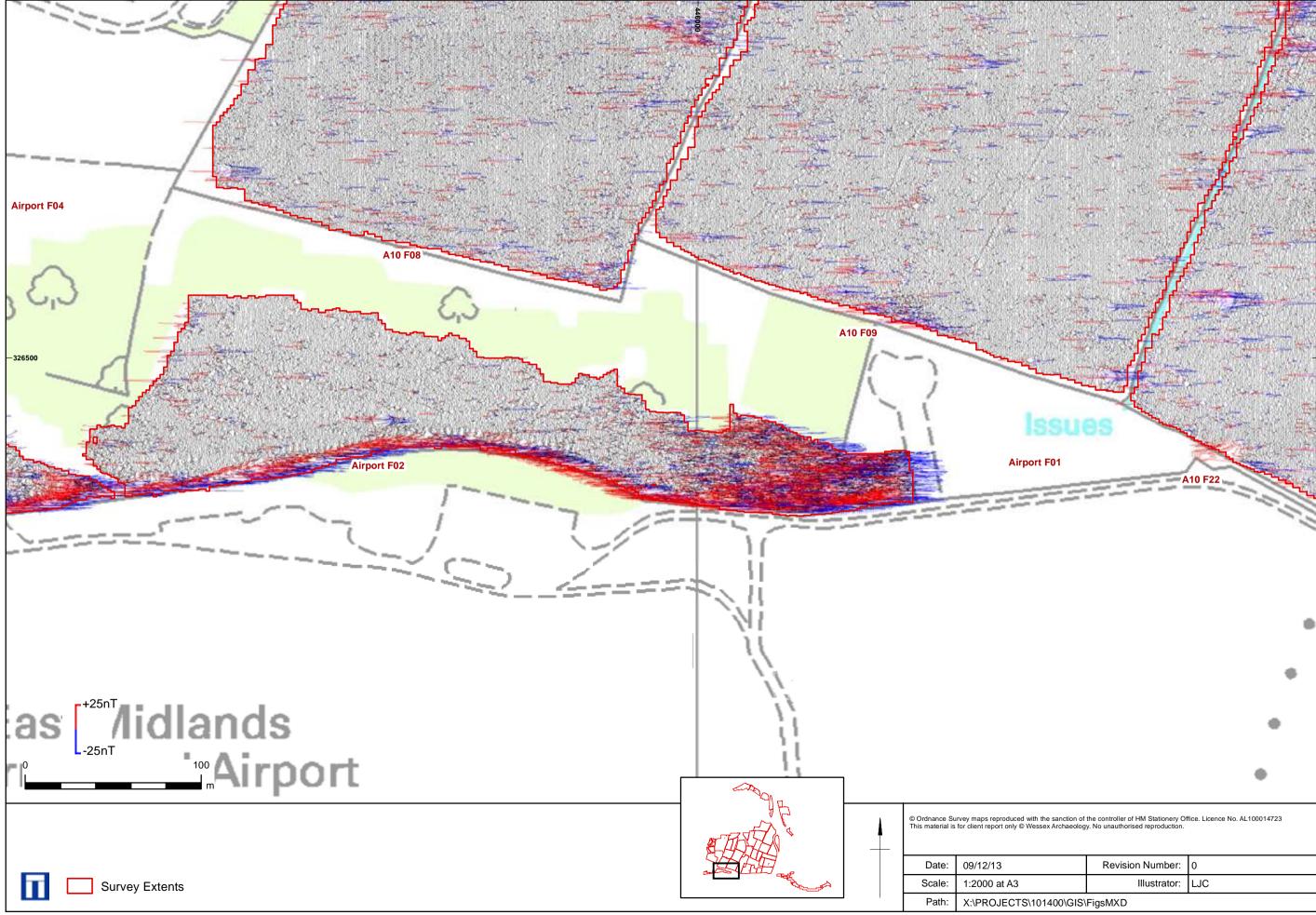




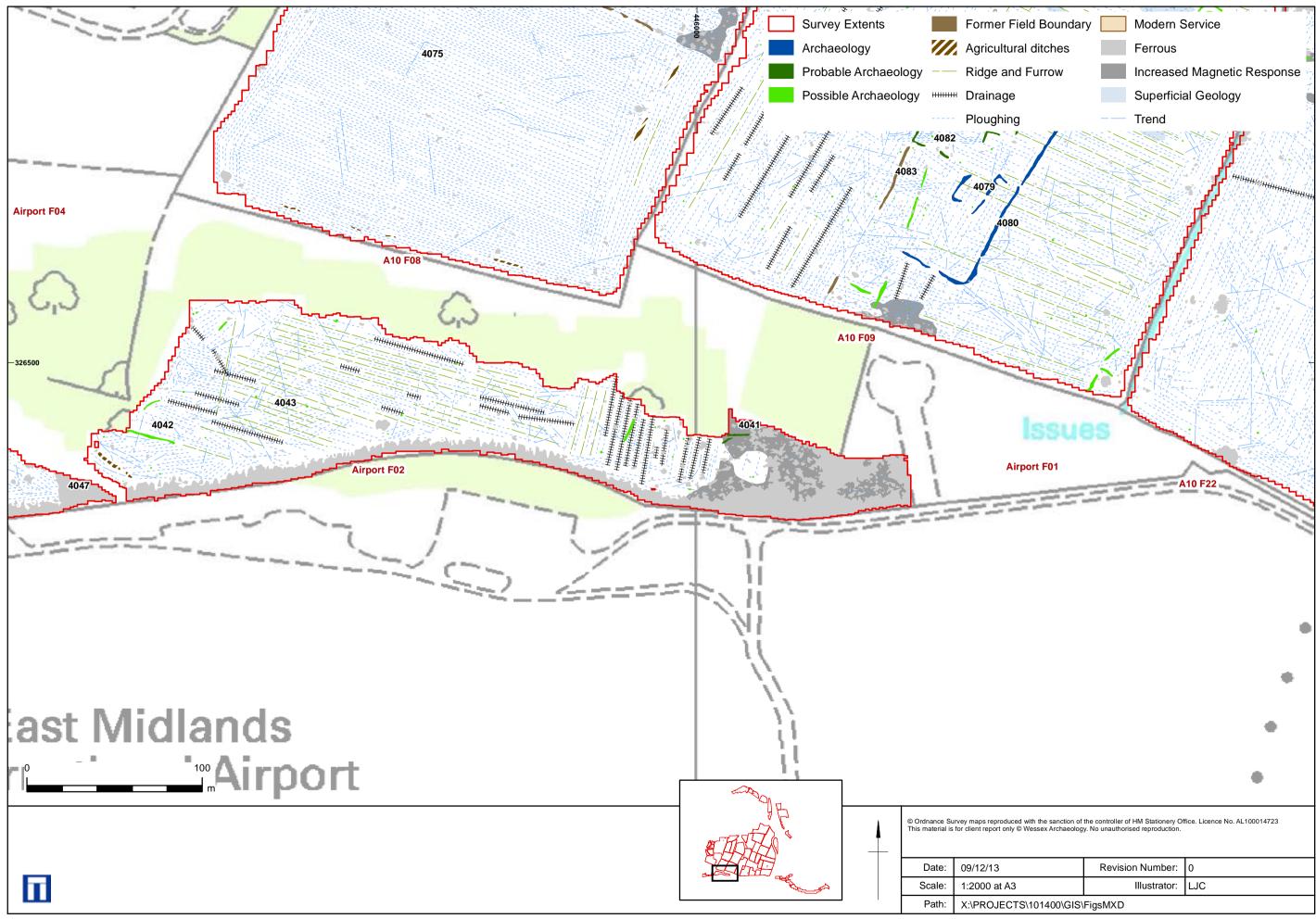


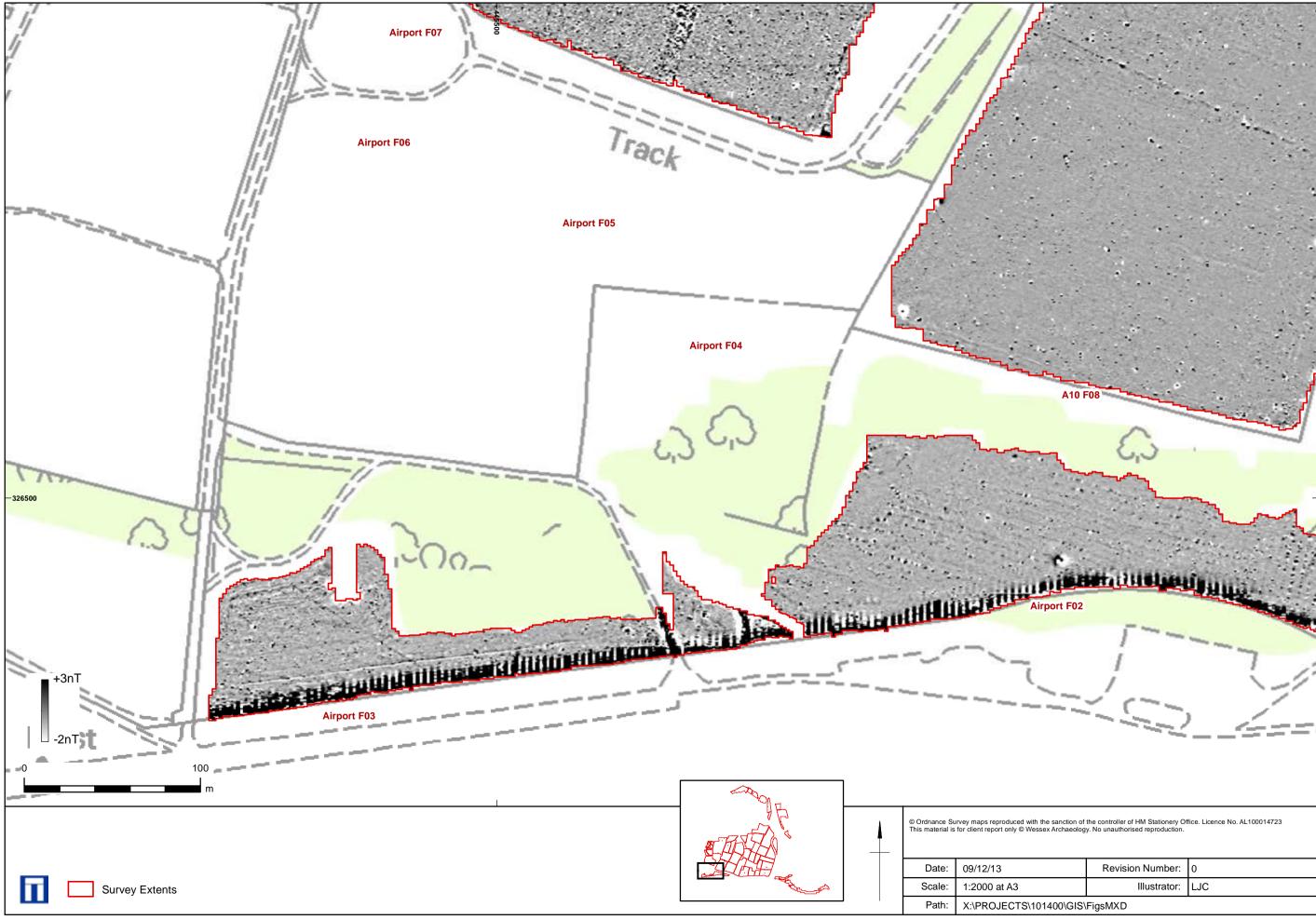


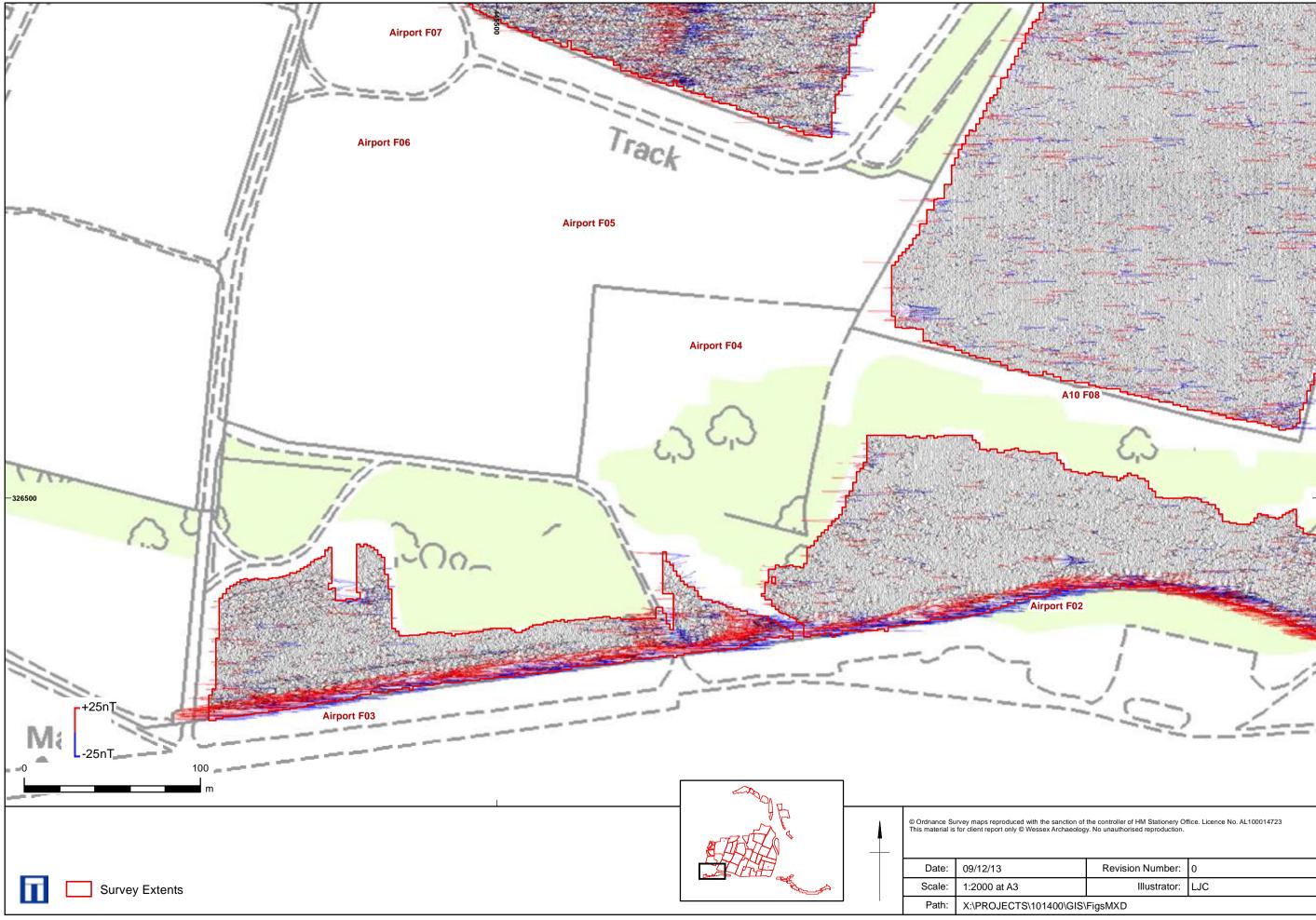




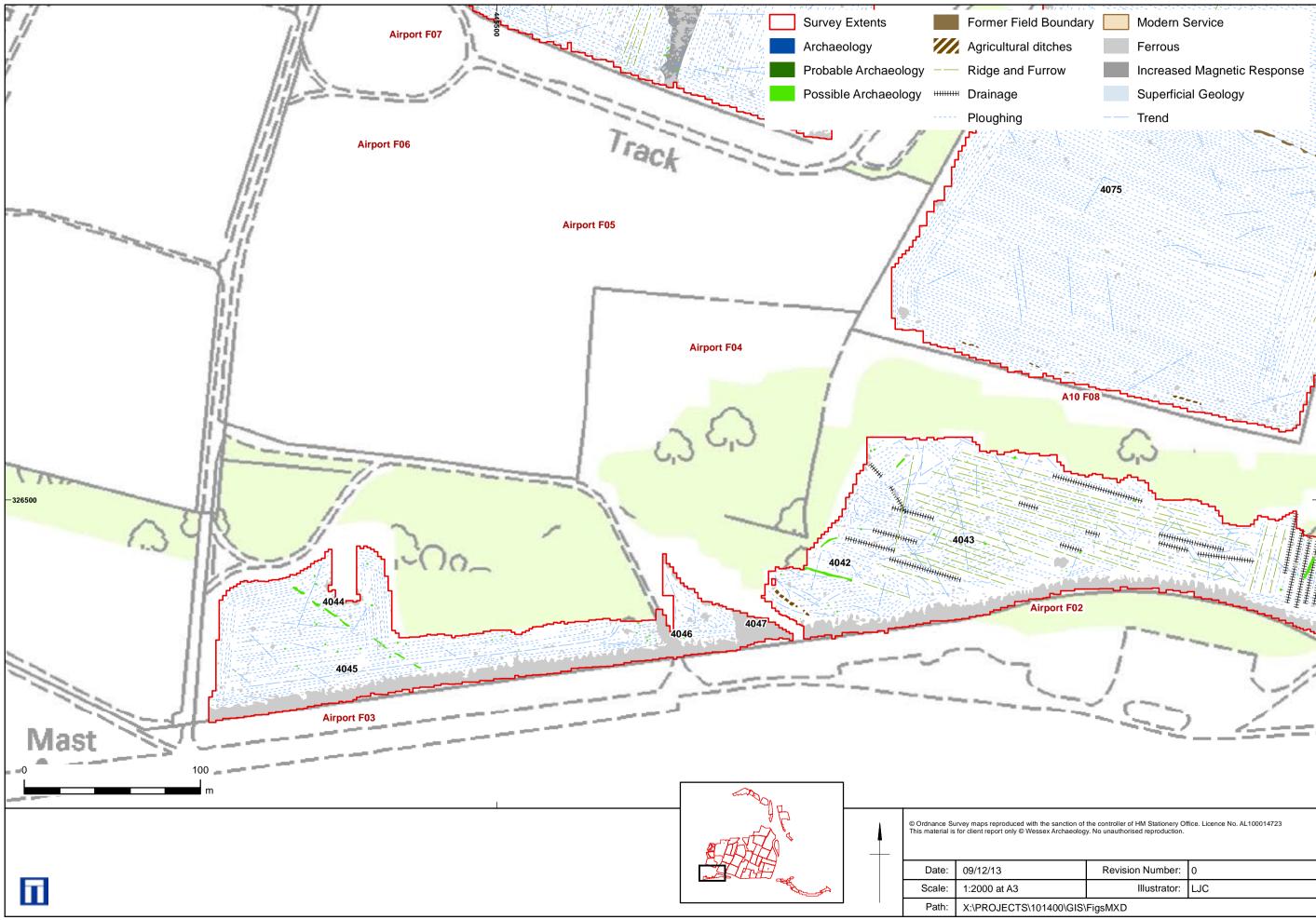
XY Trace: Fields Airport F01 and Airport F02
Figure 27

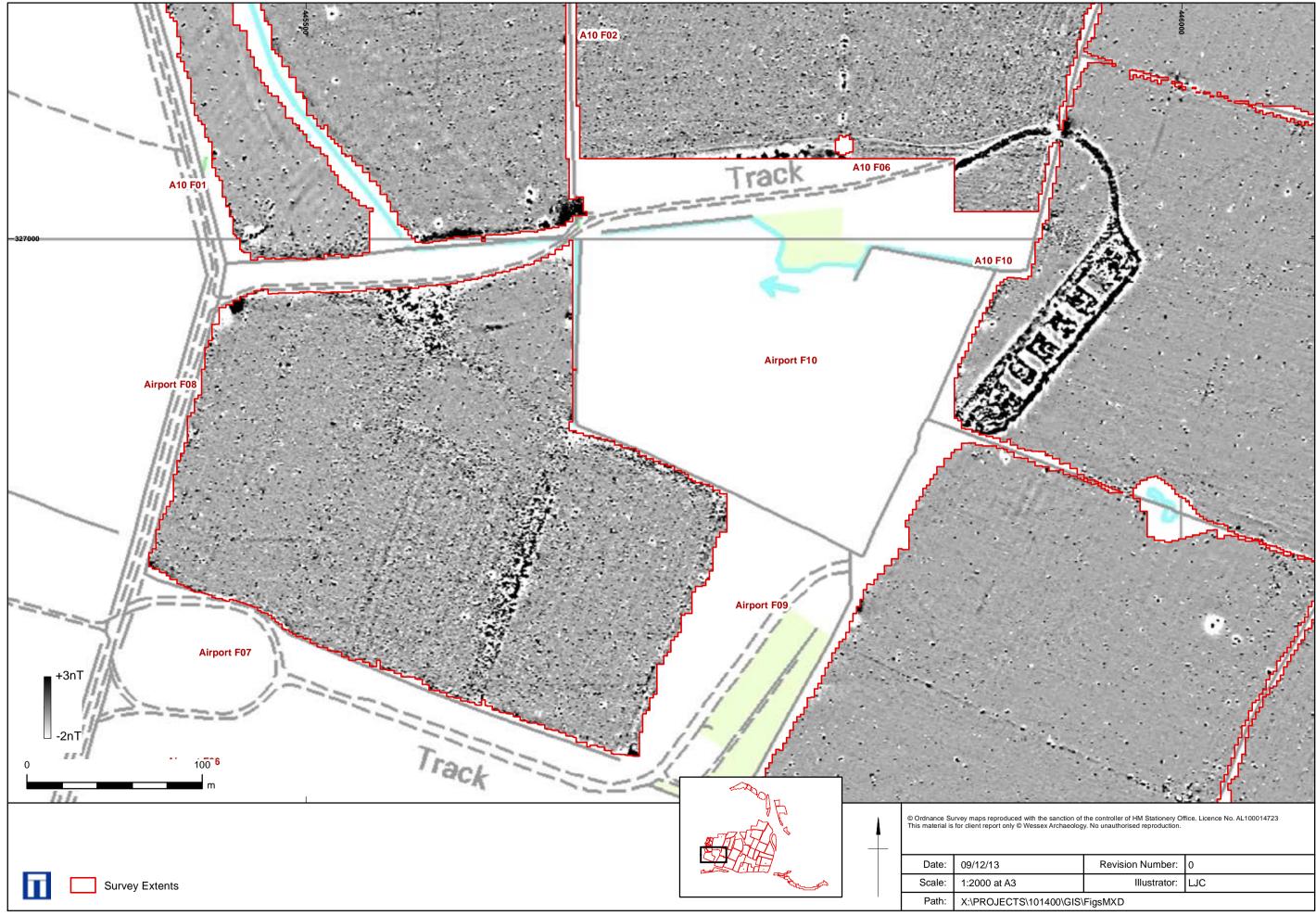


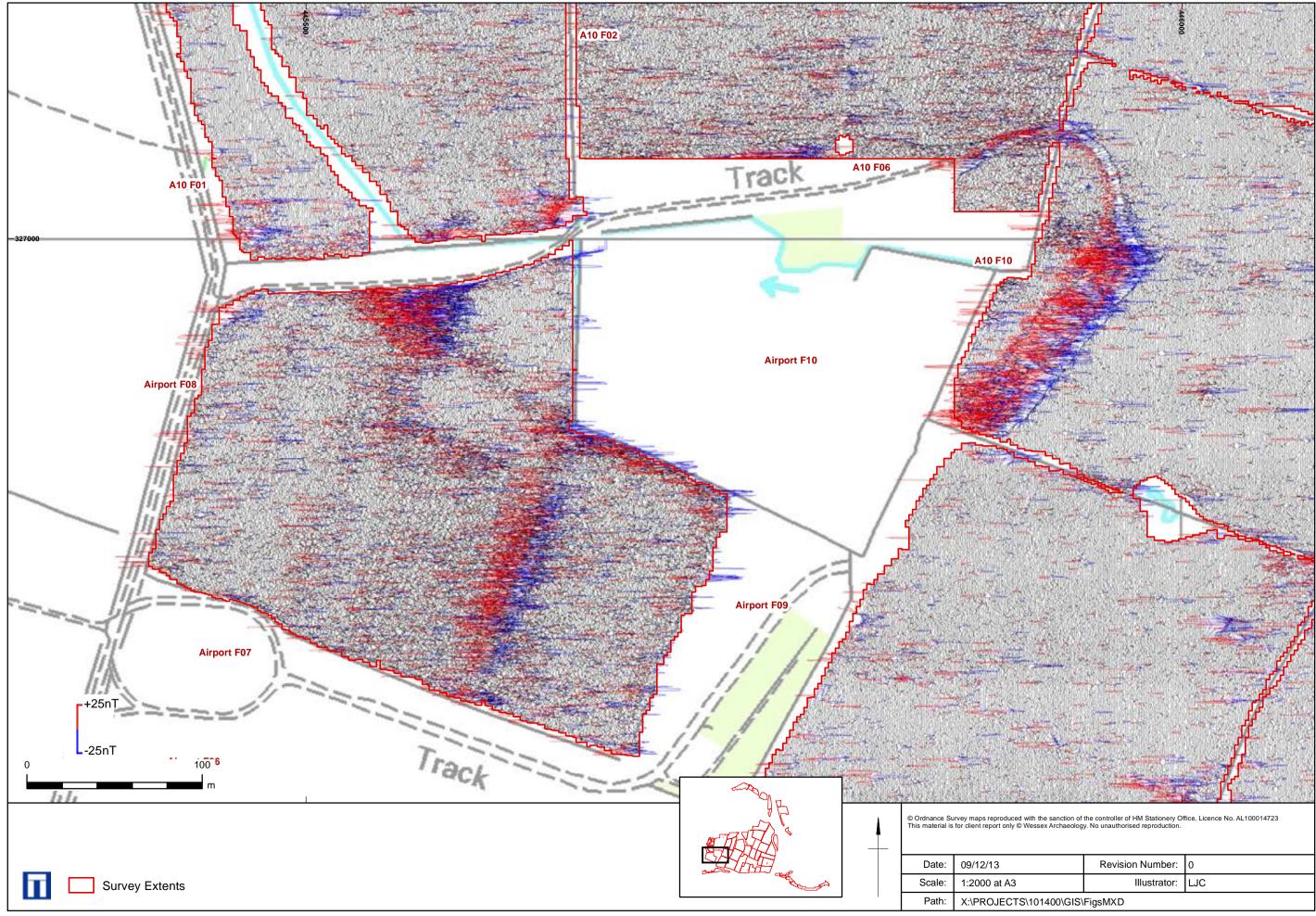




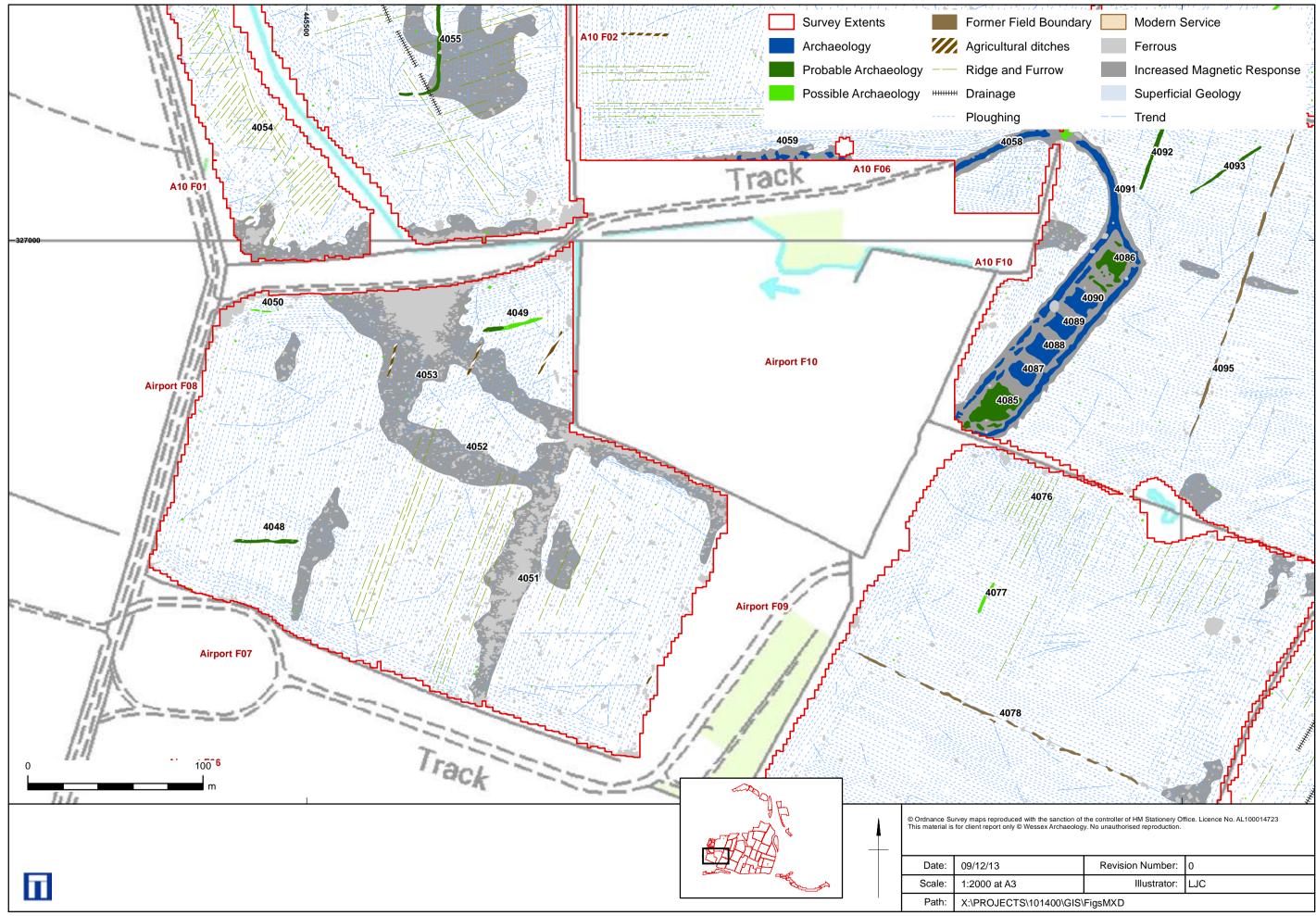
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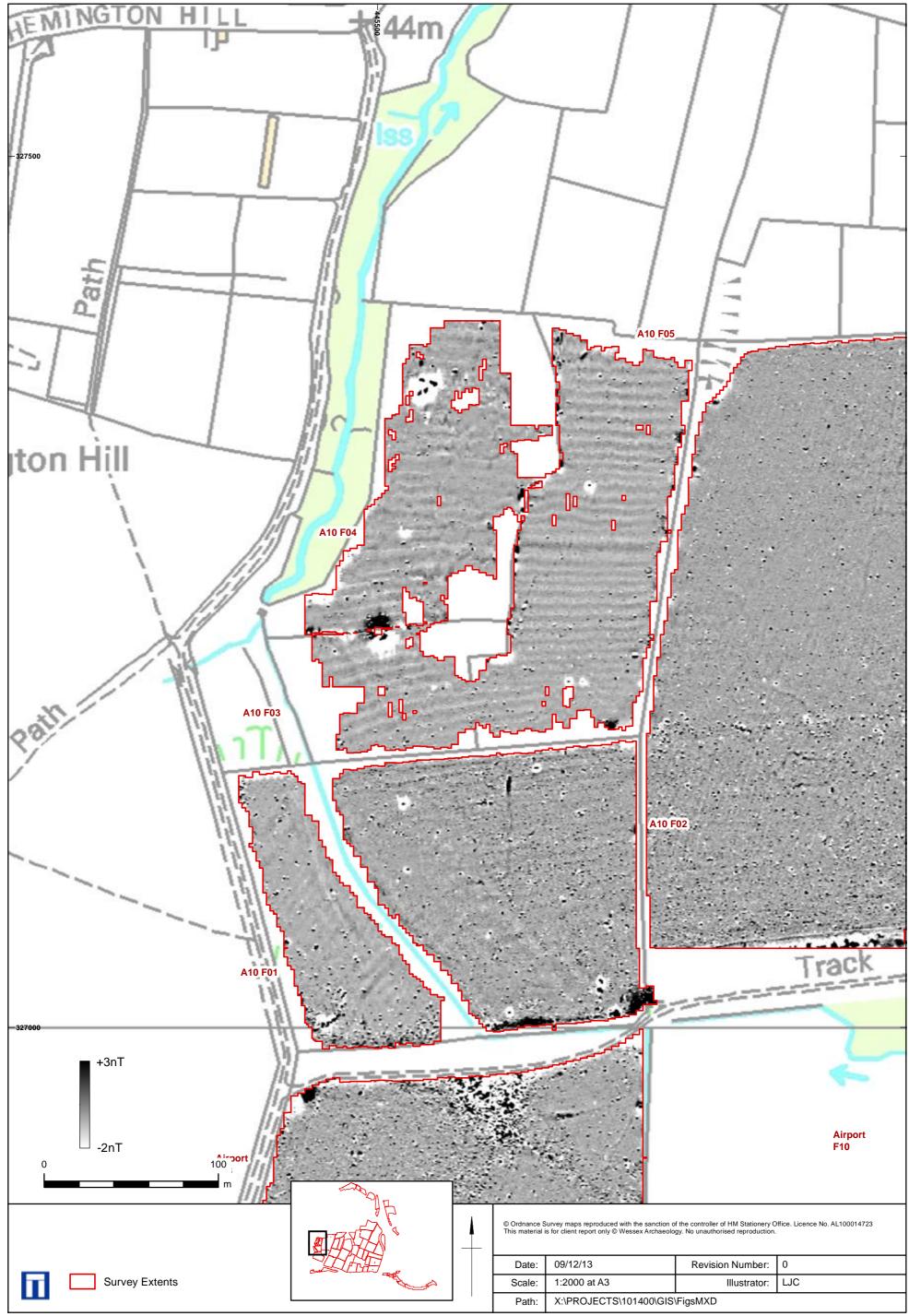


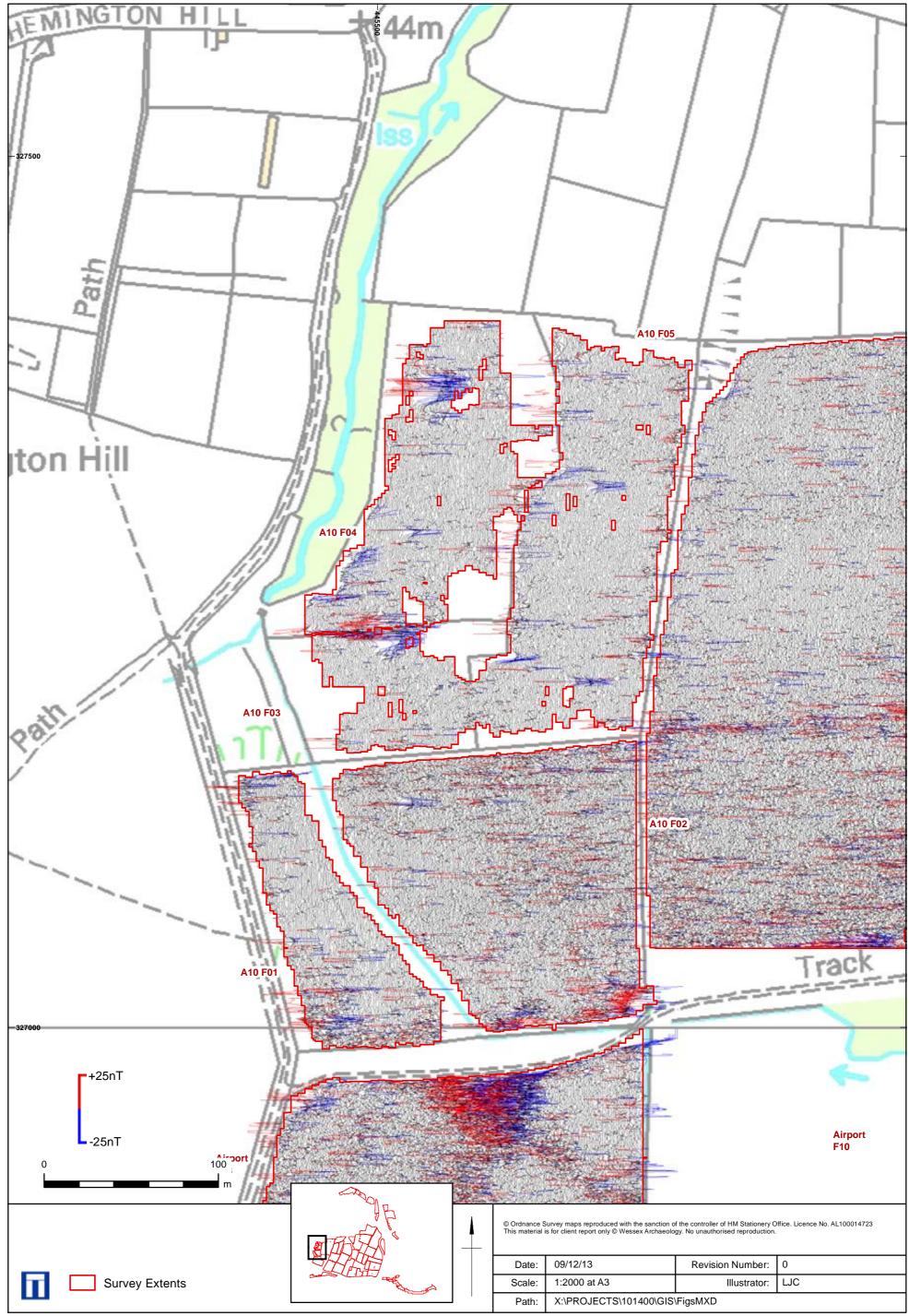




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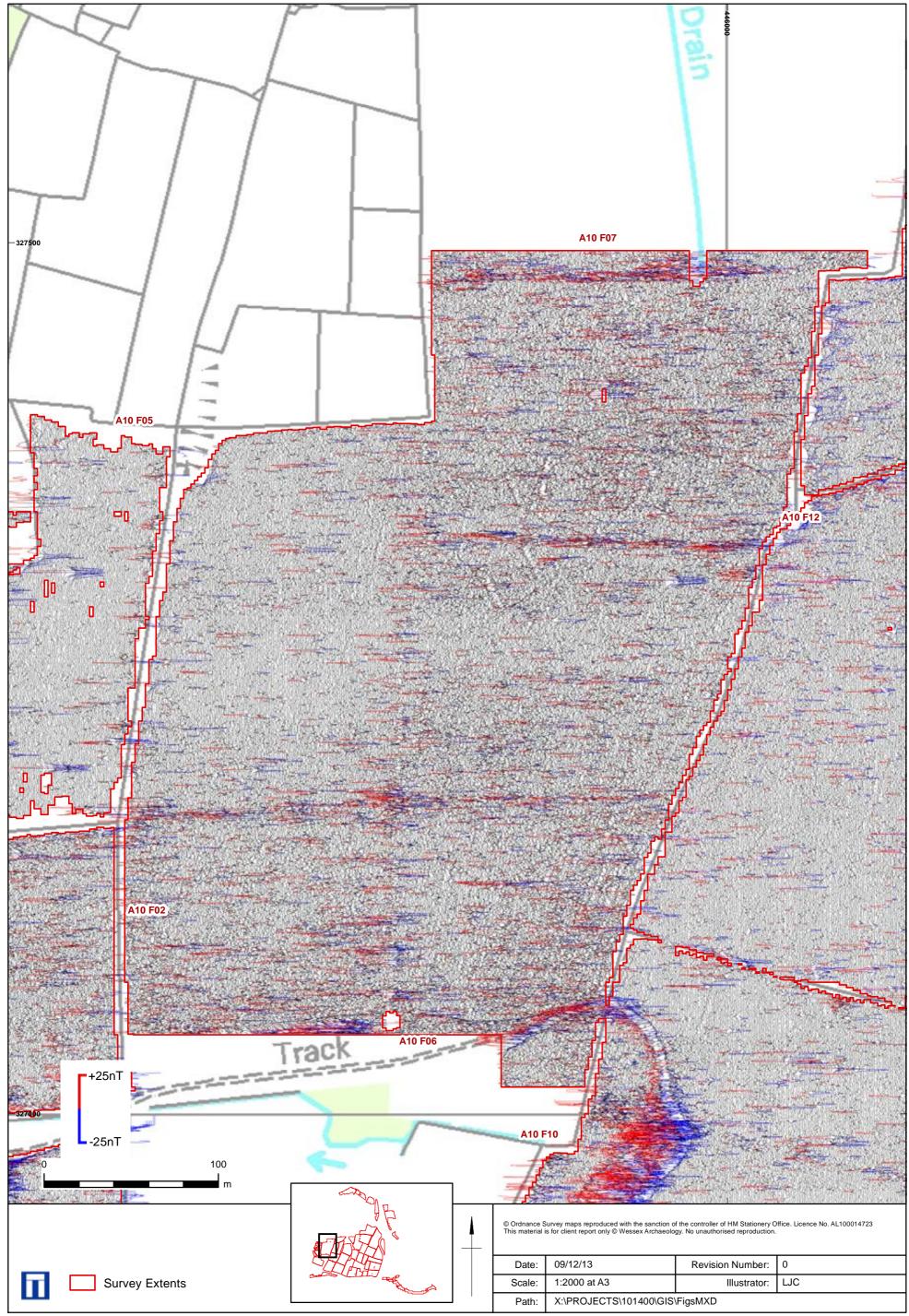


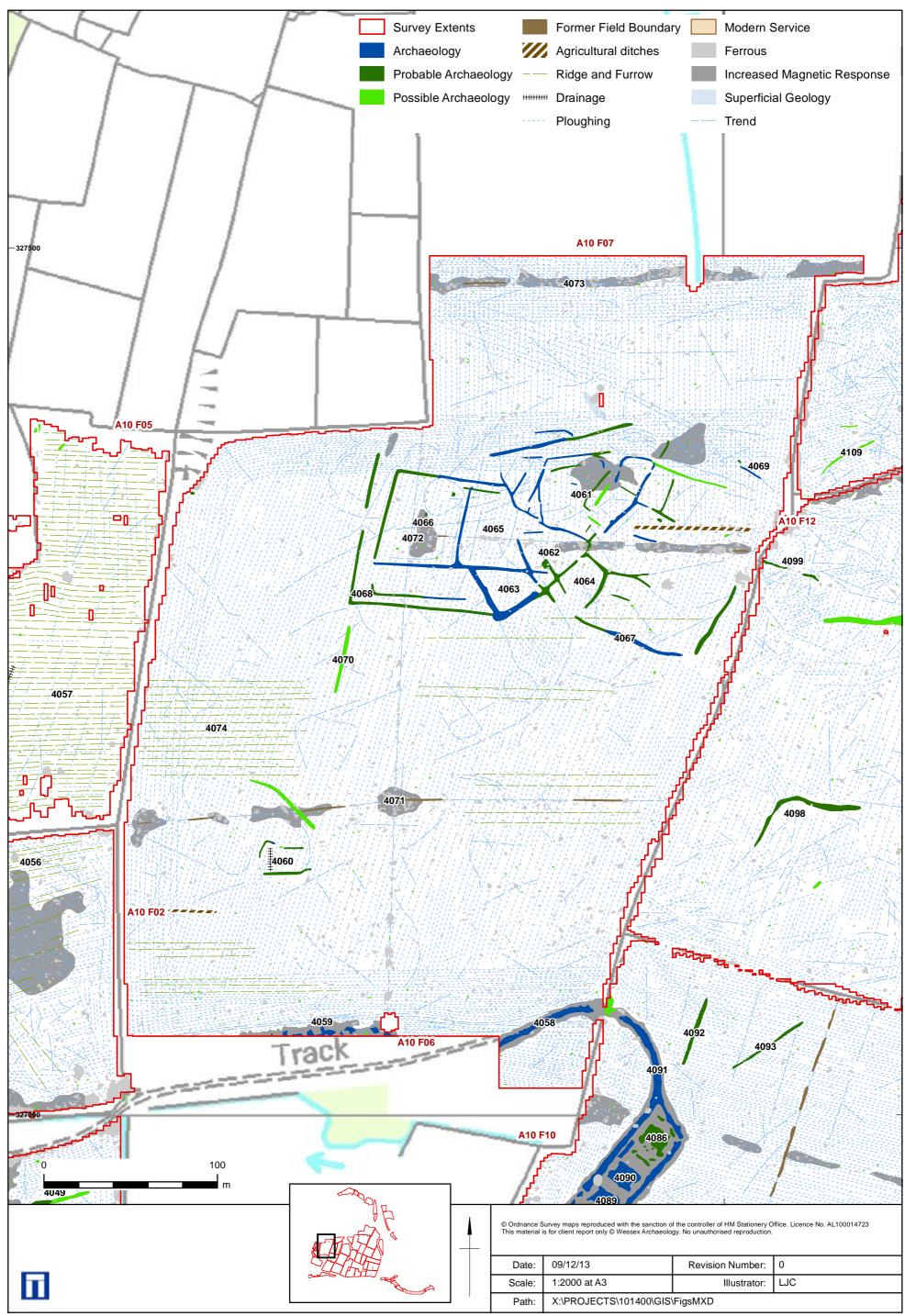




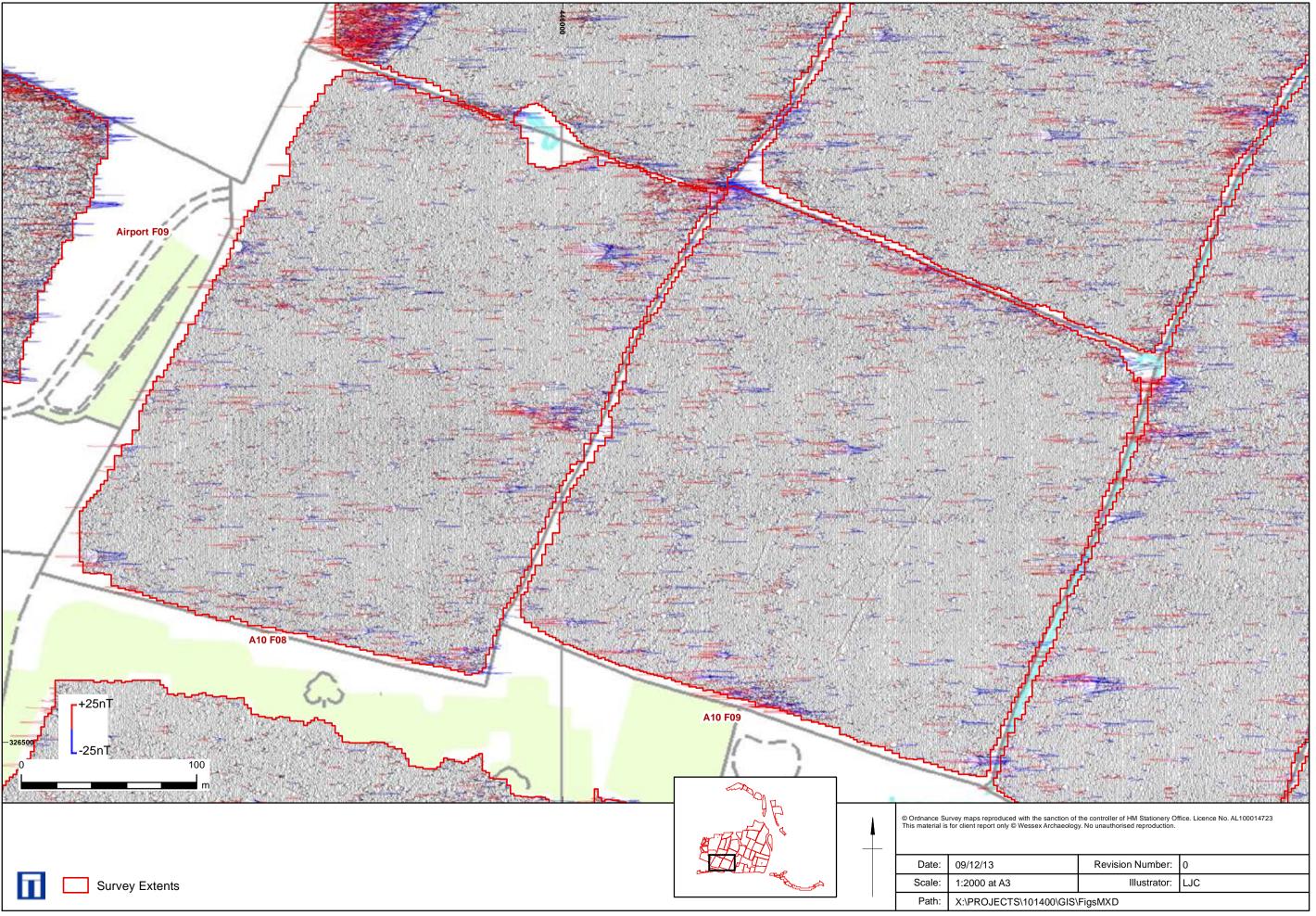


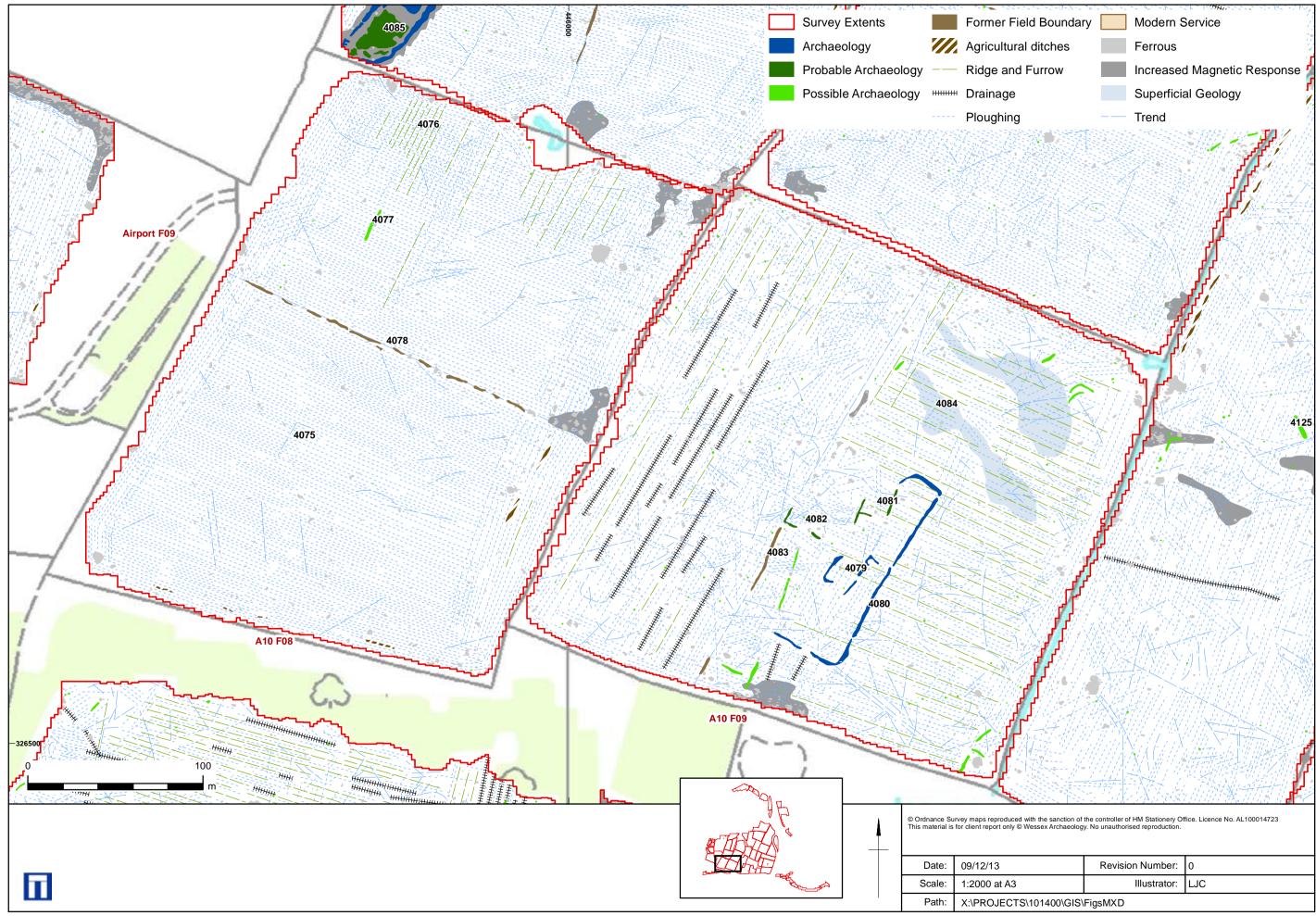


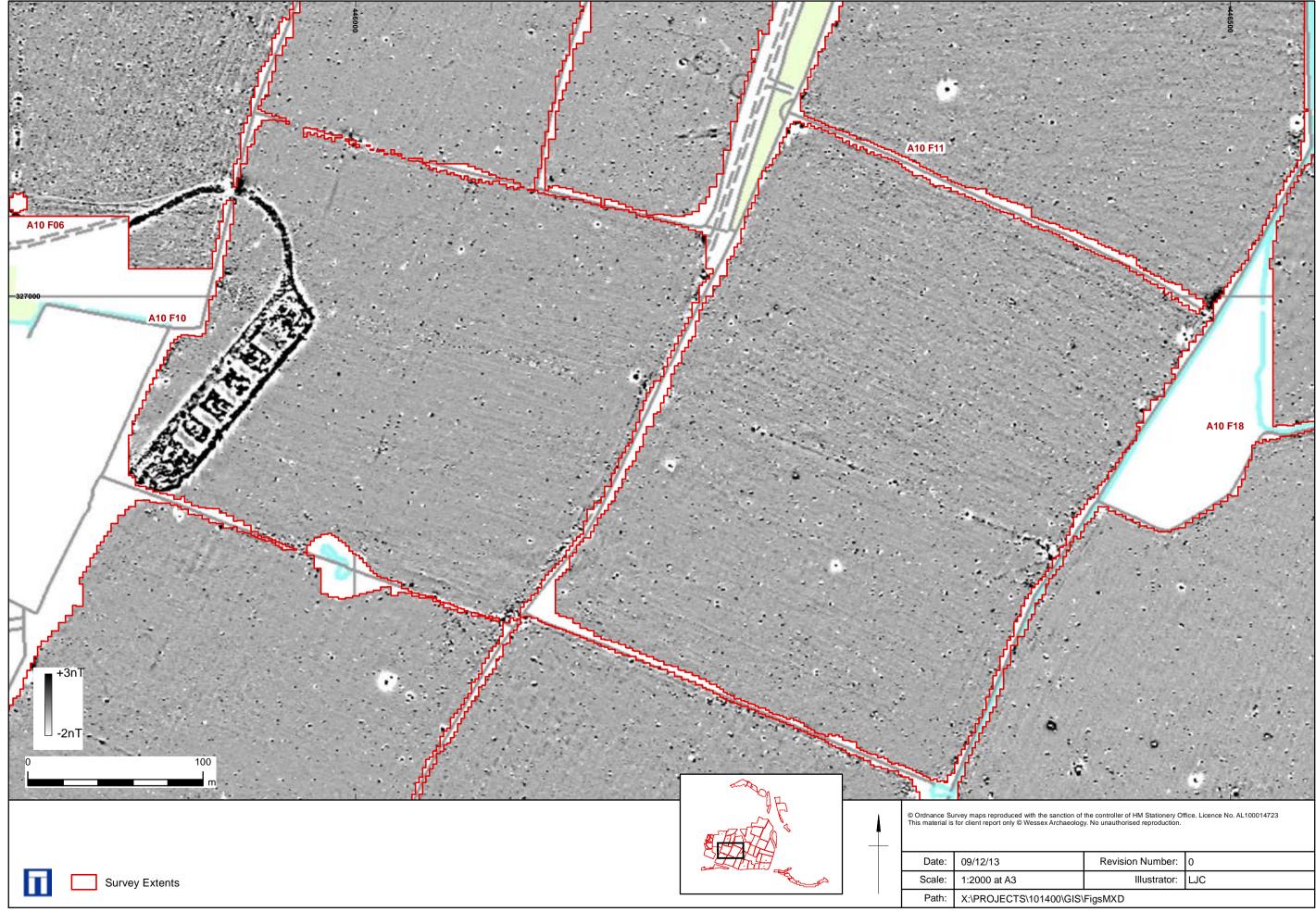


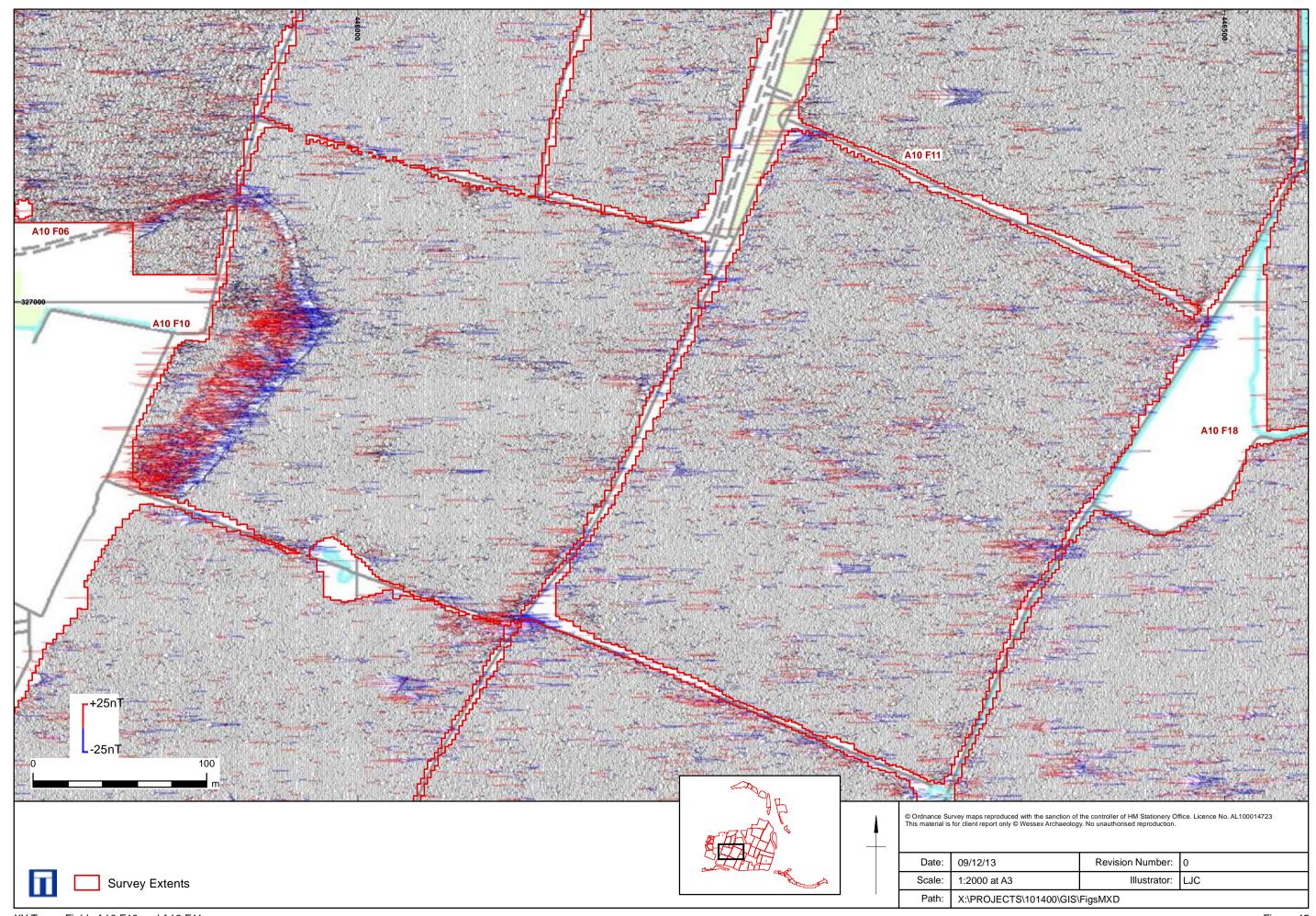


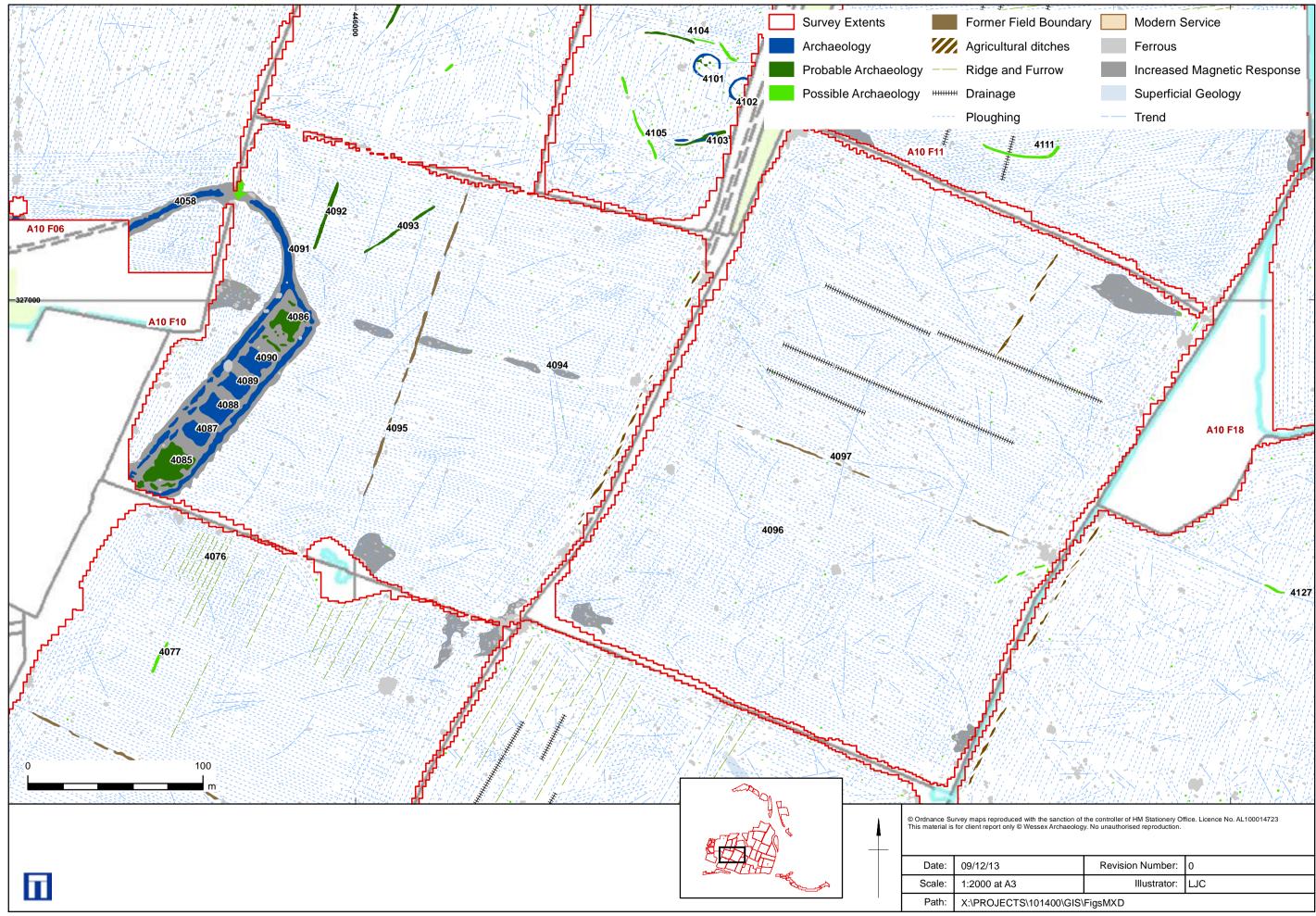


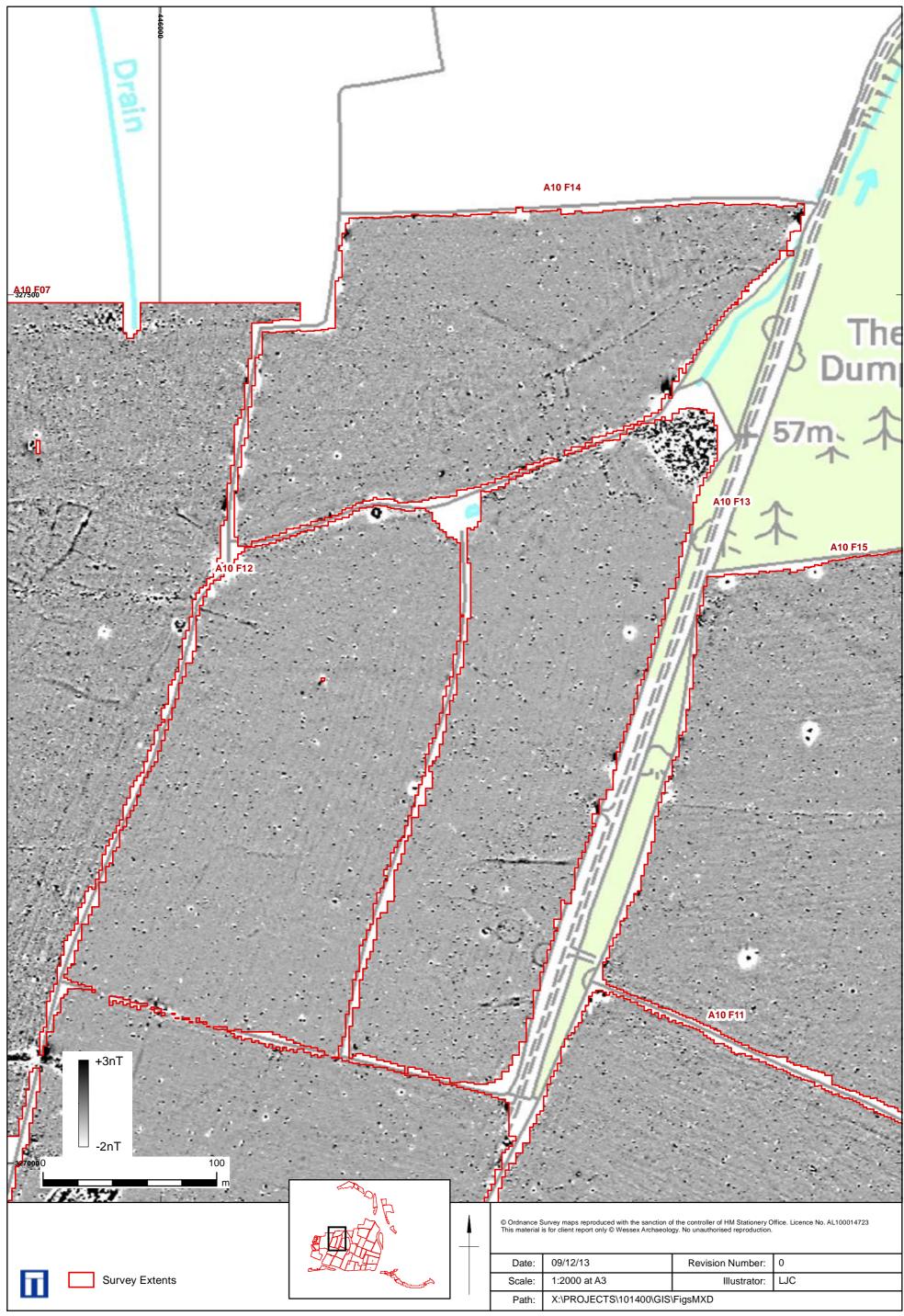


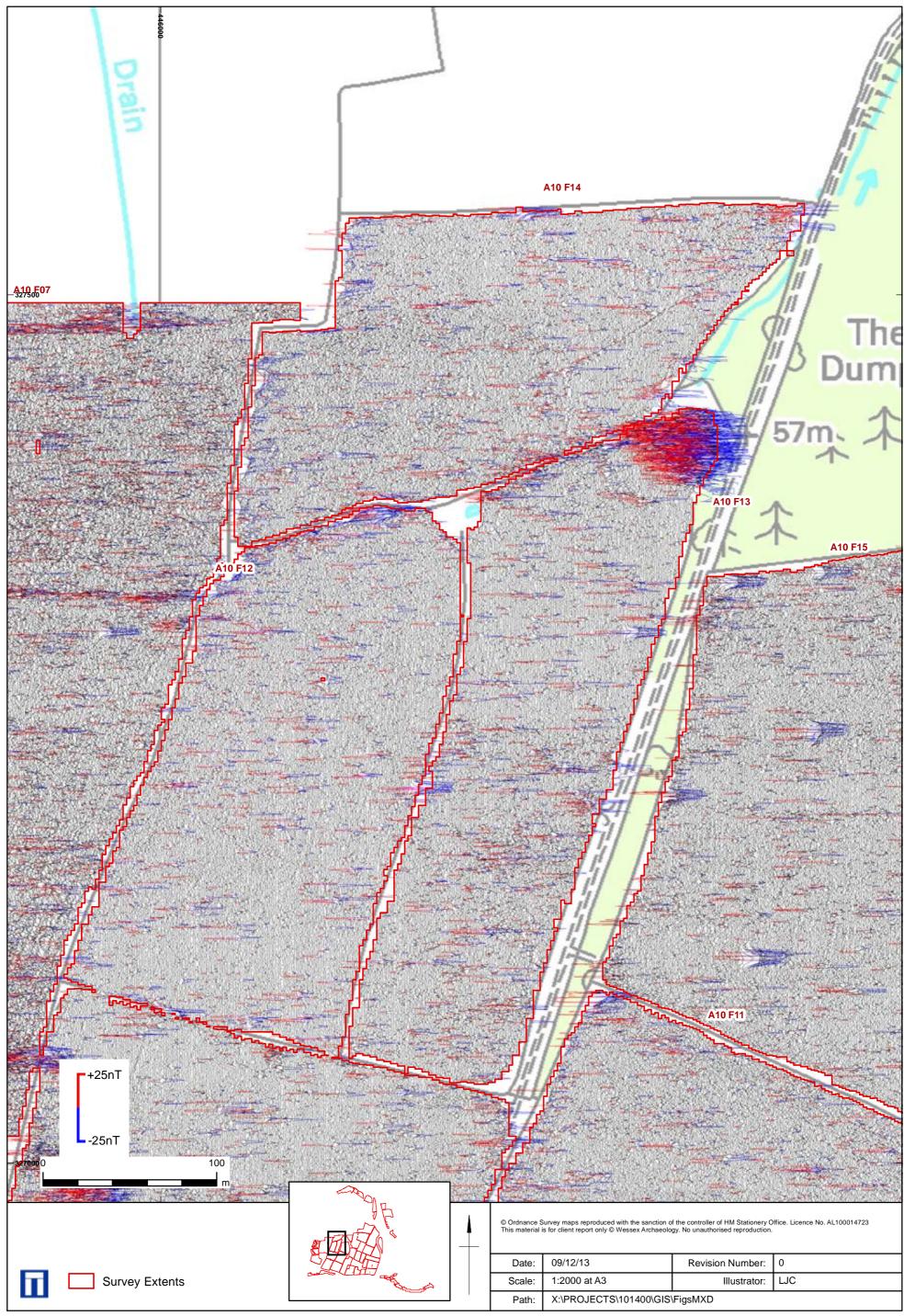


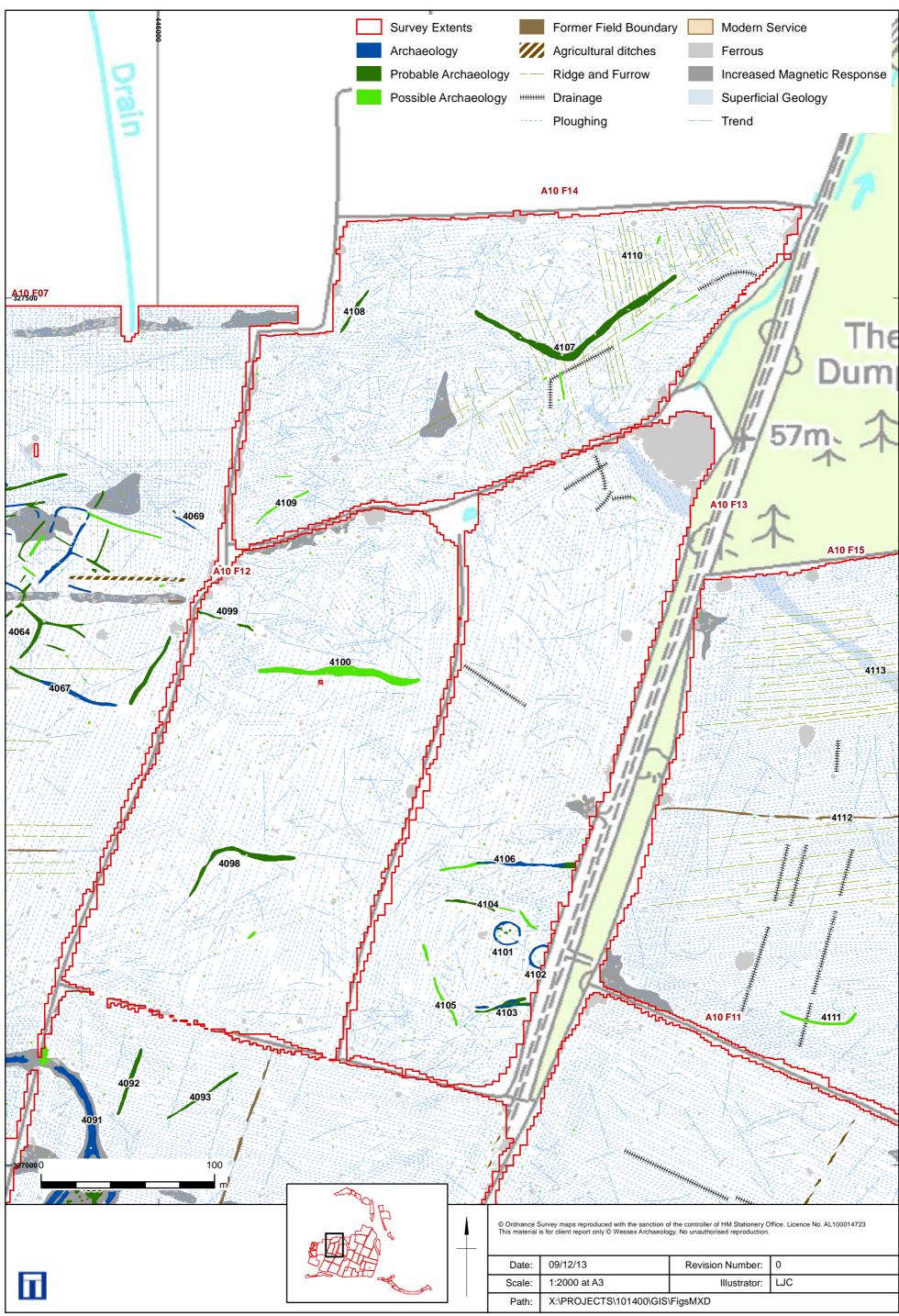


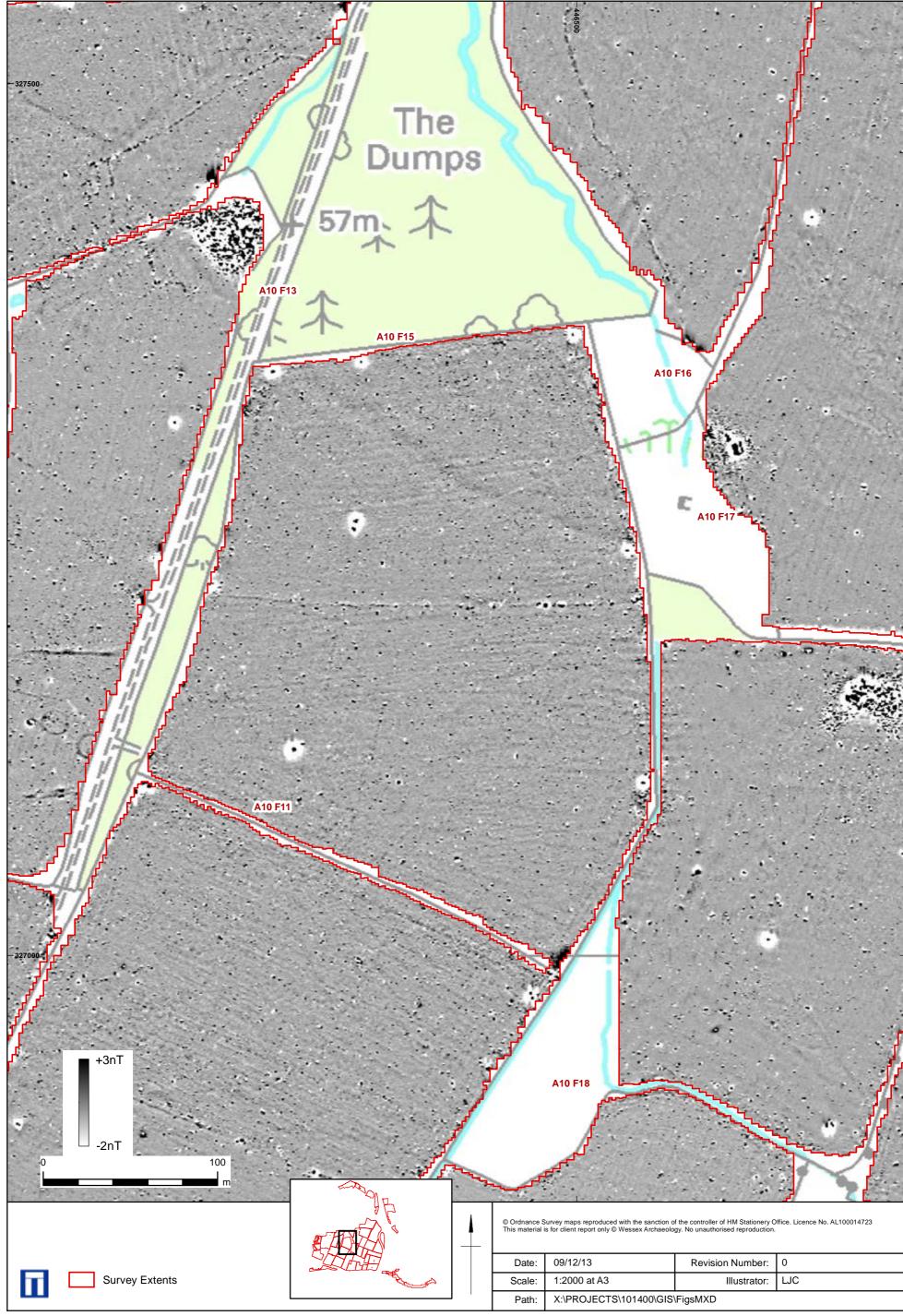


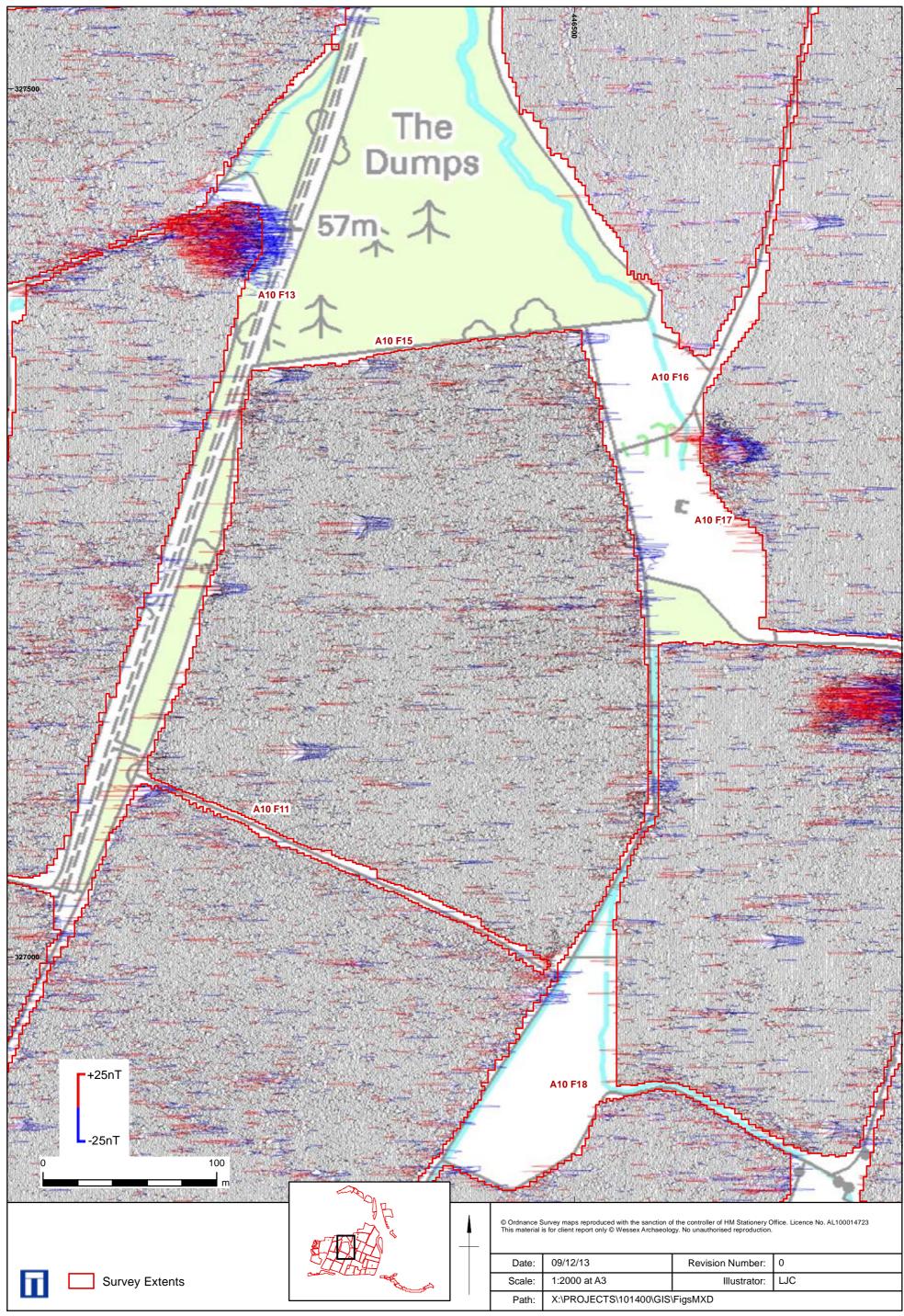


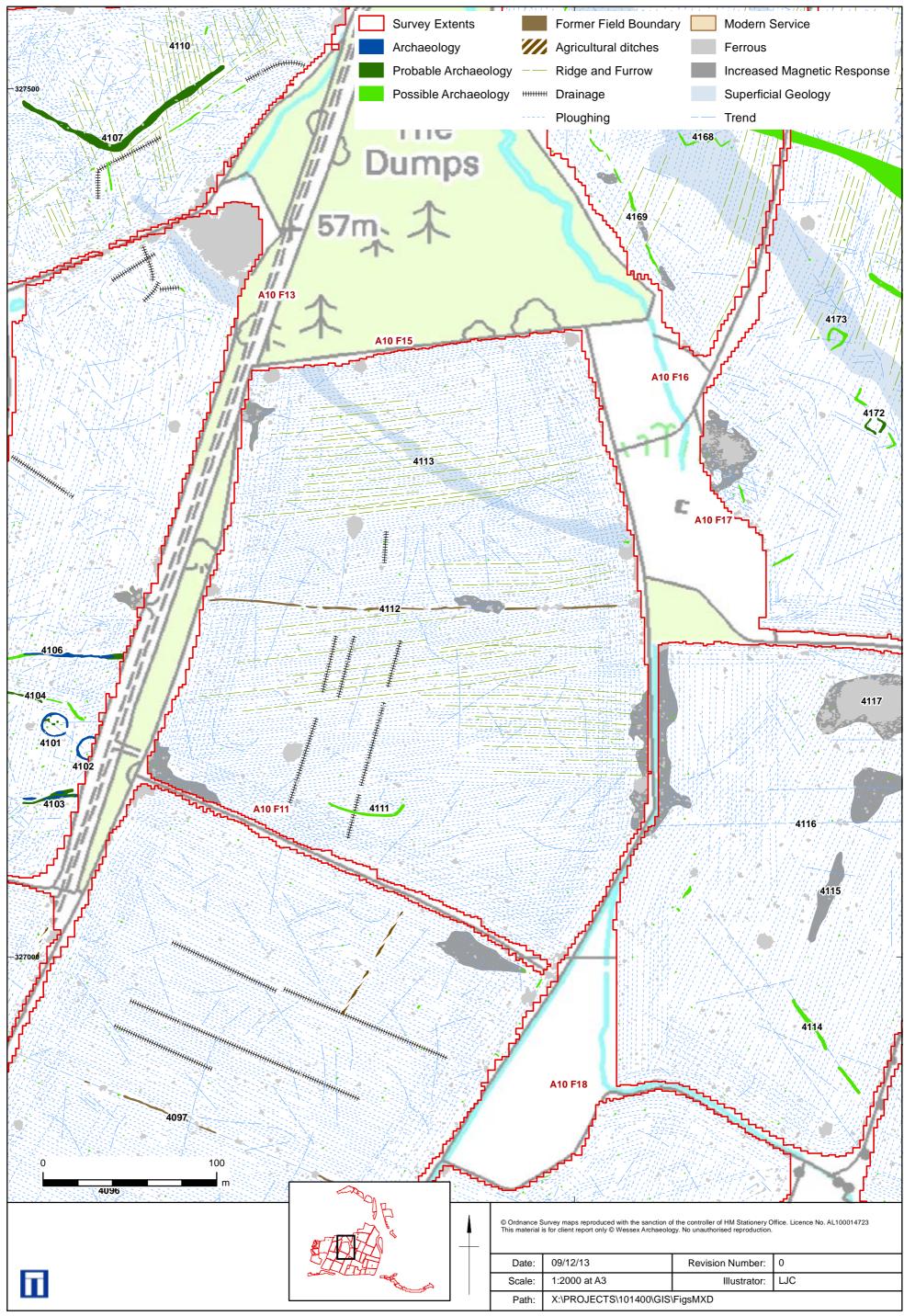




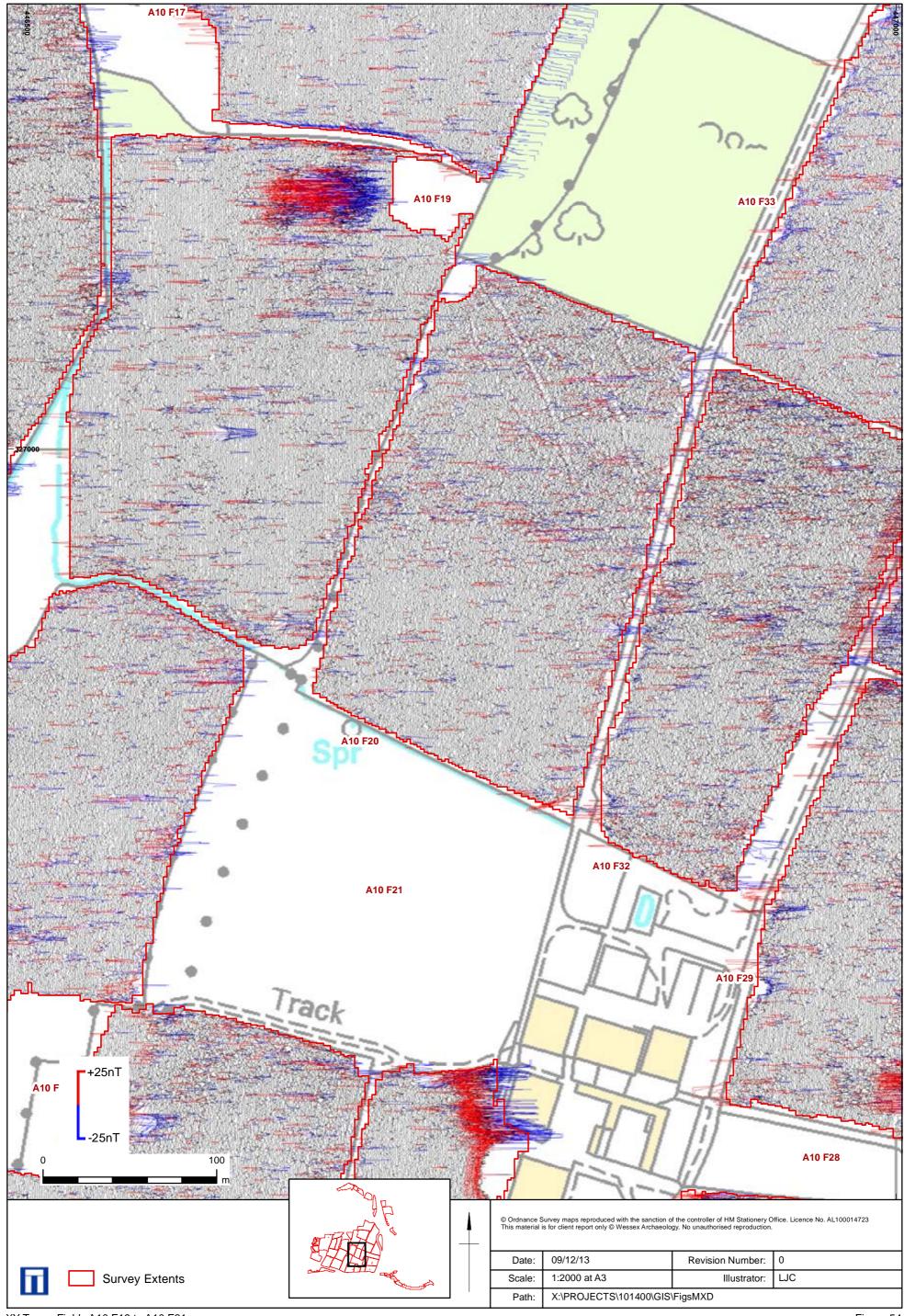


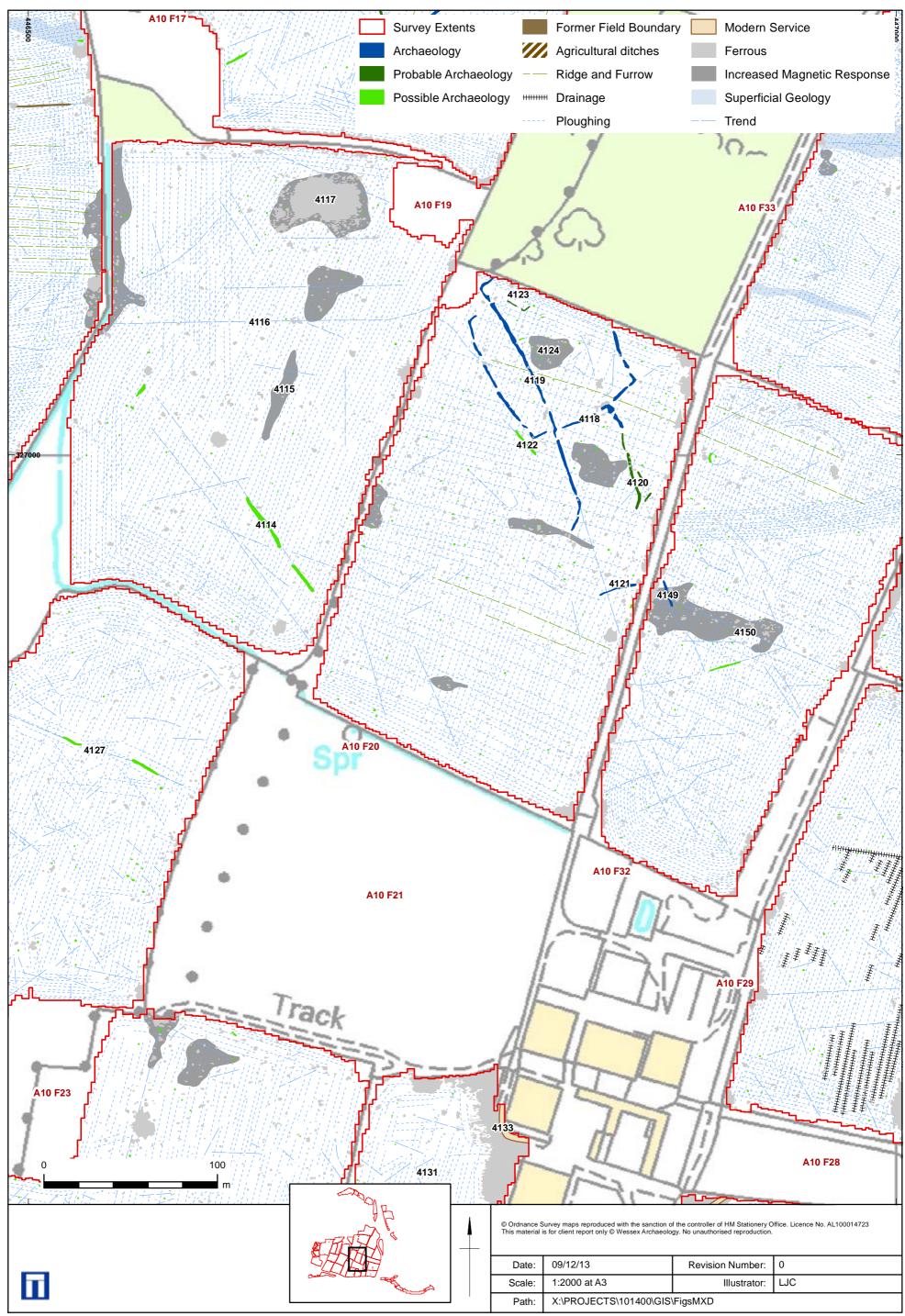


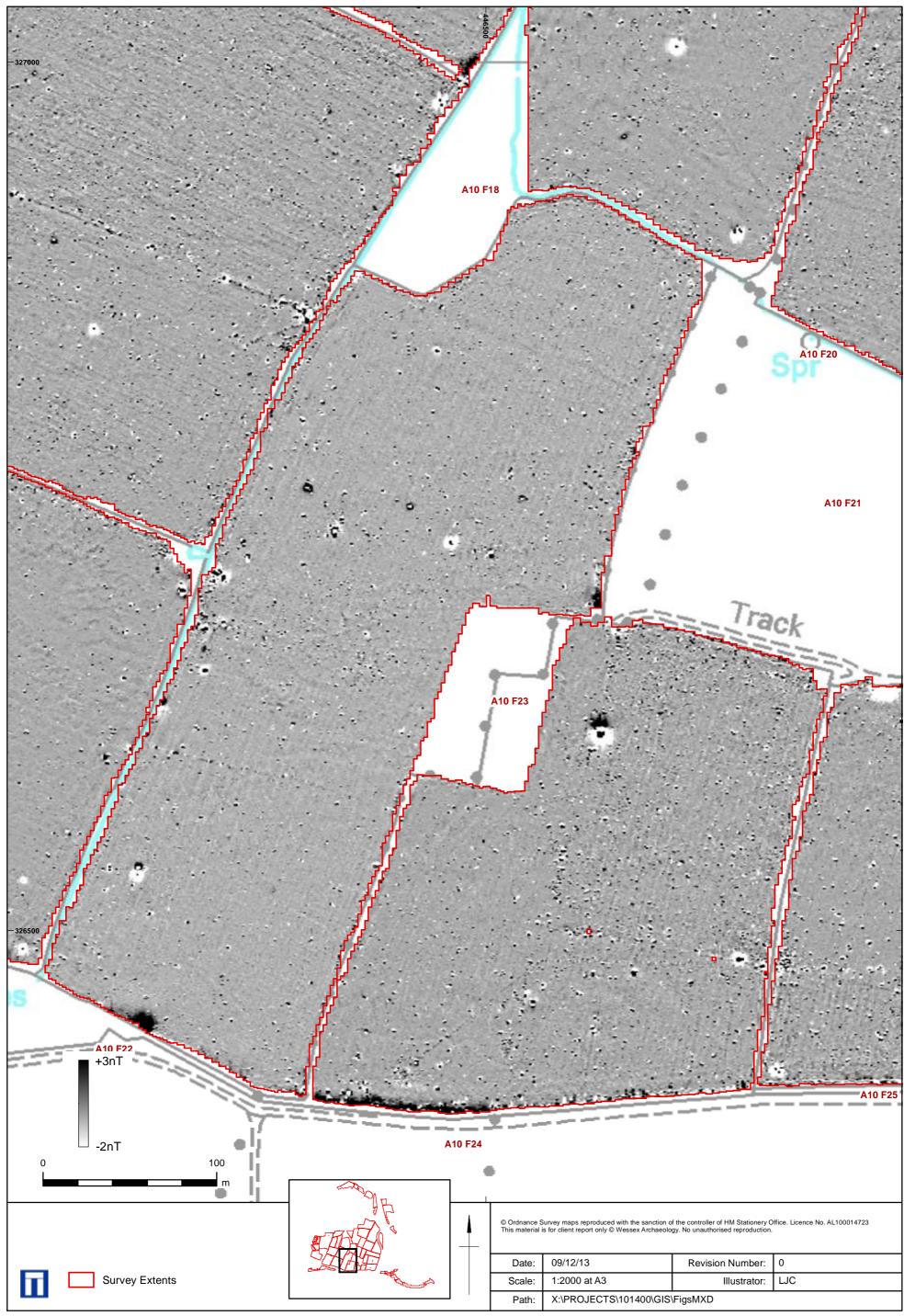


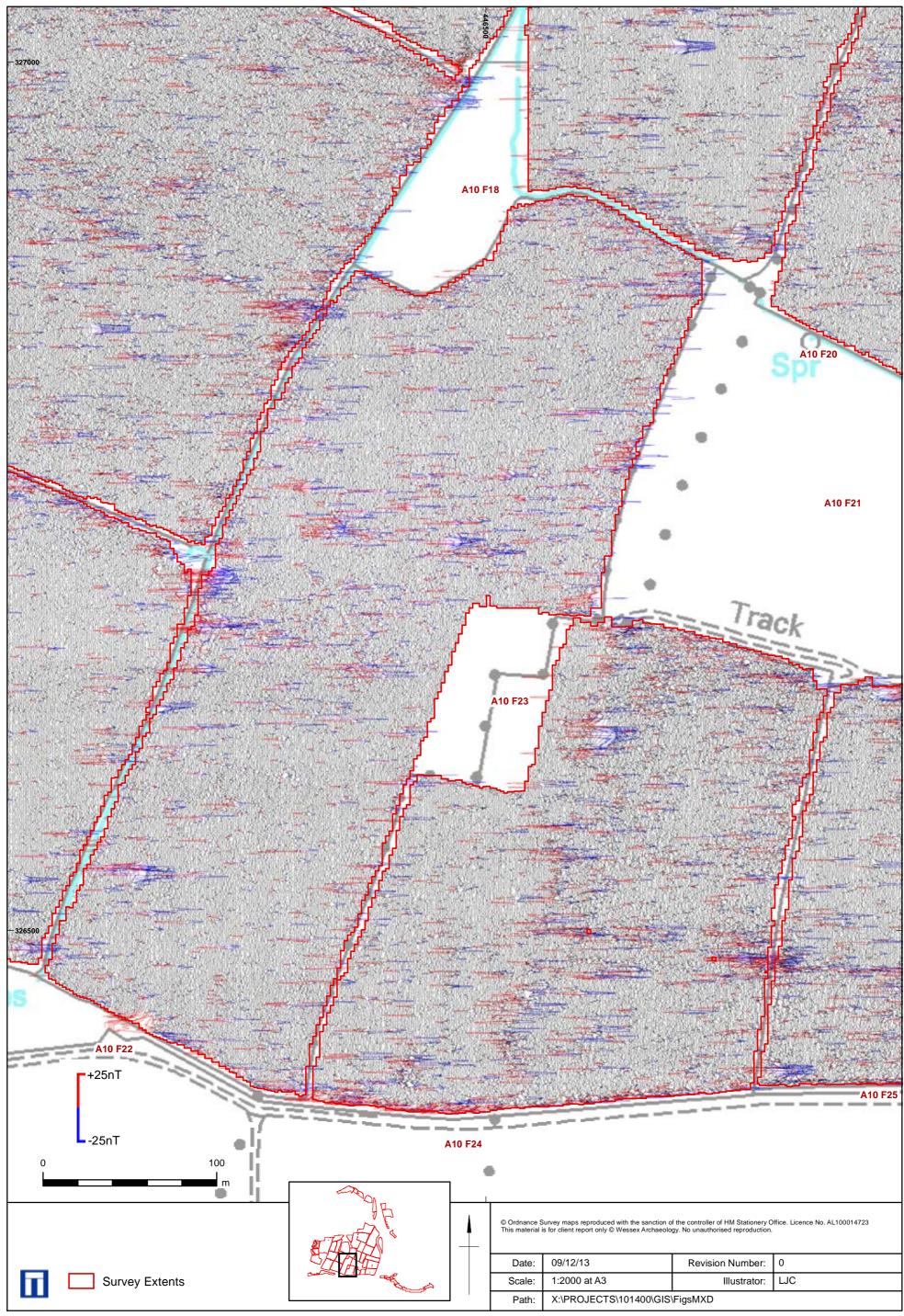


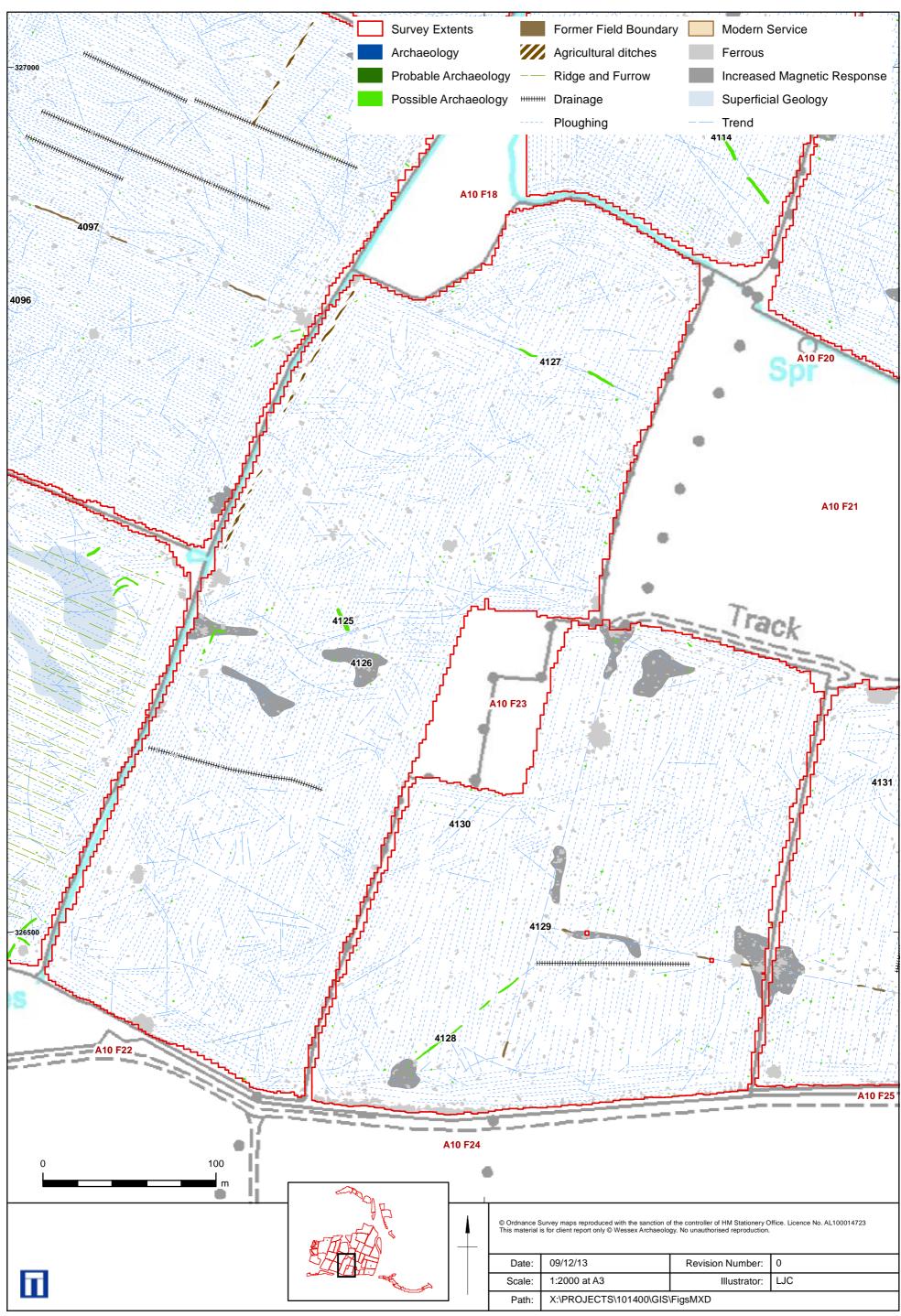


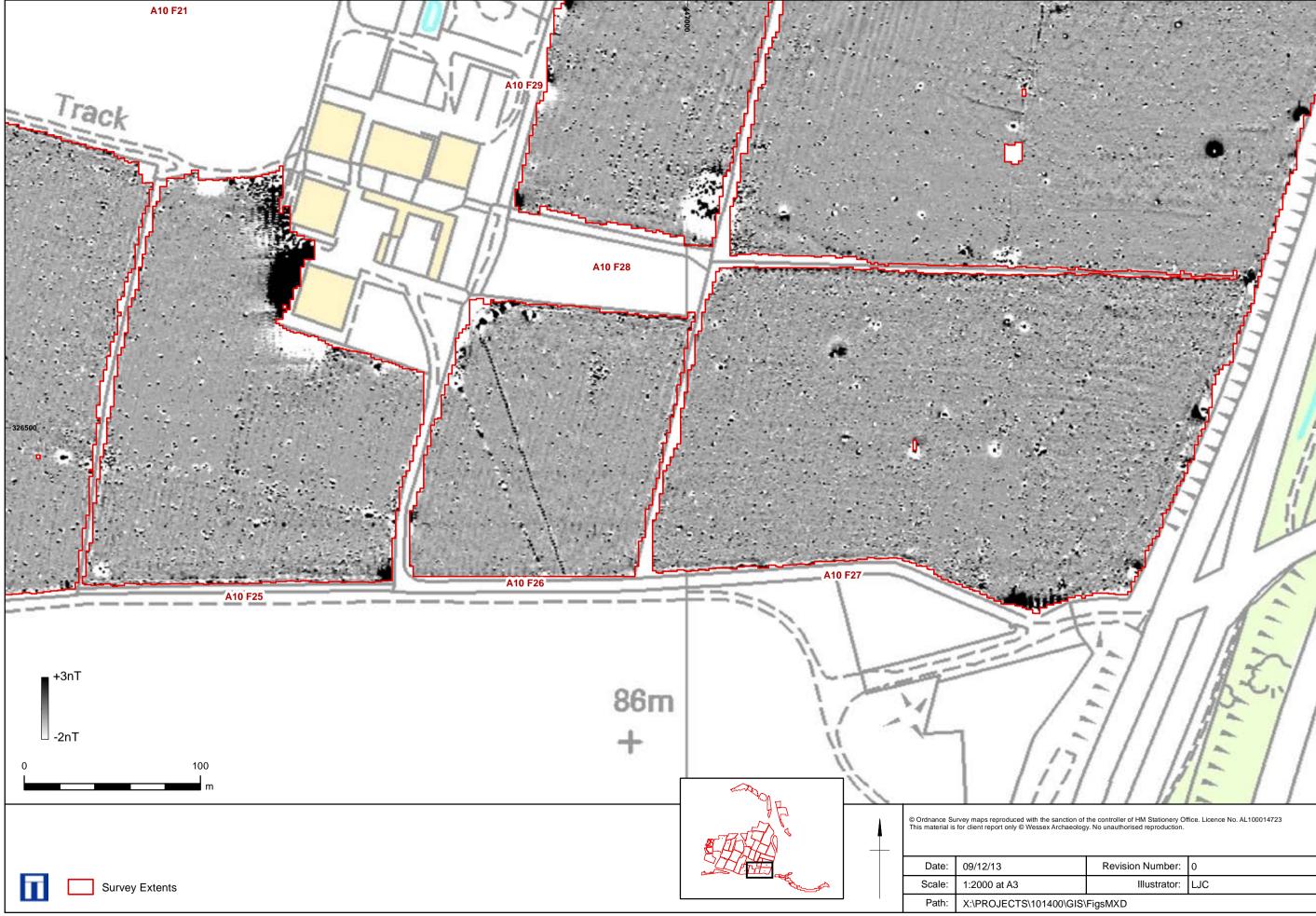




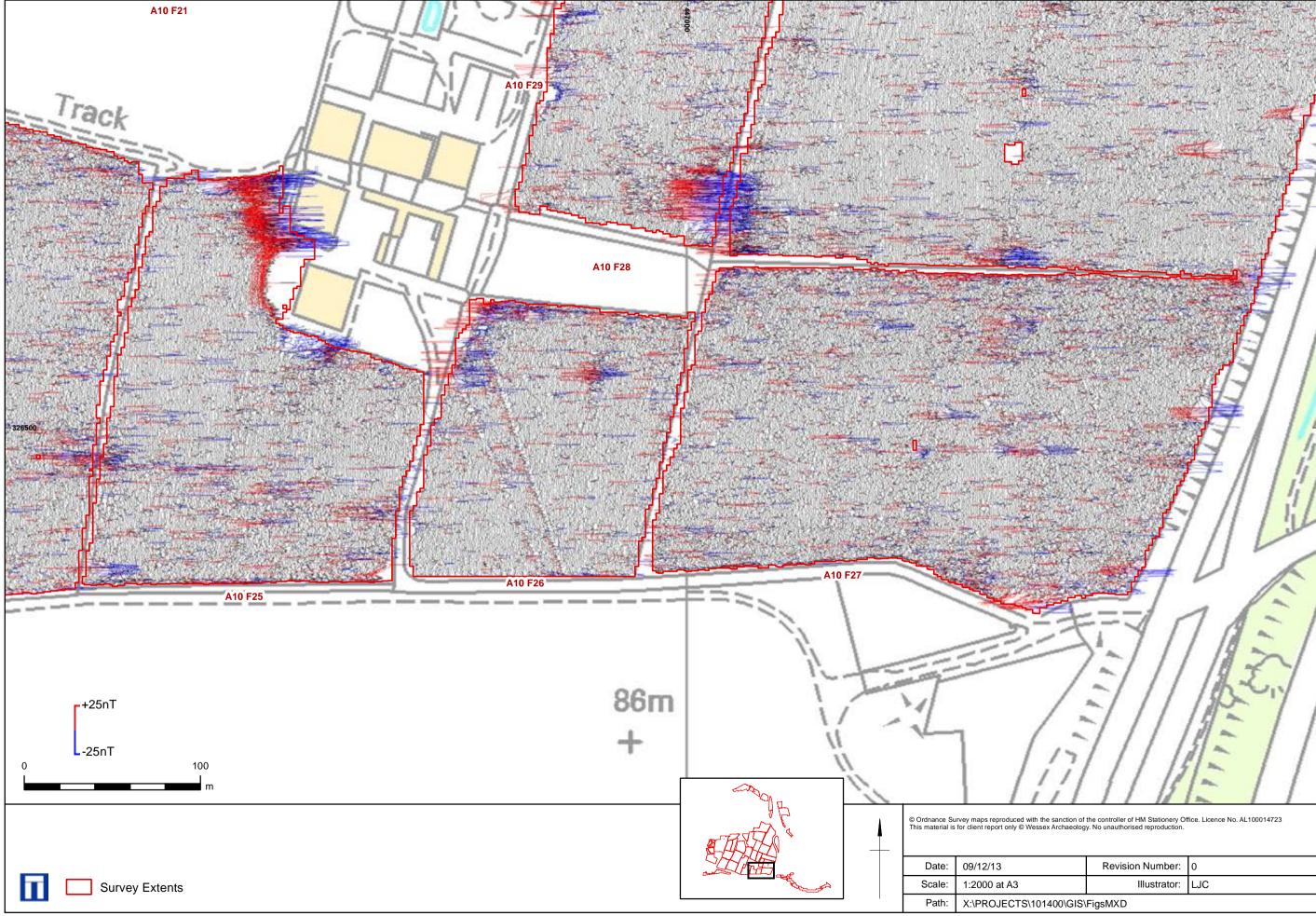




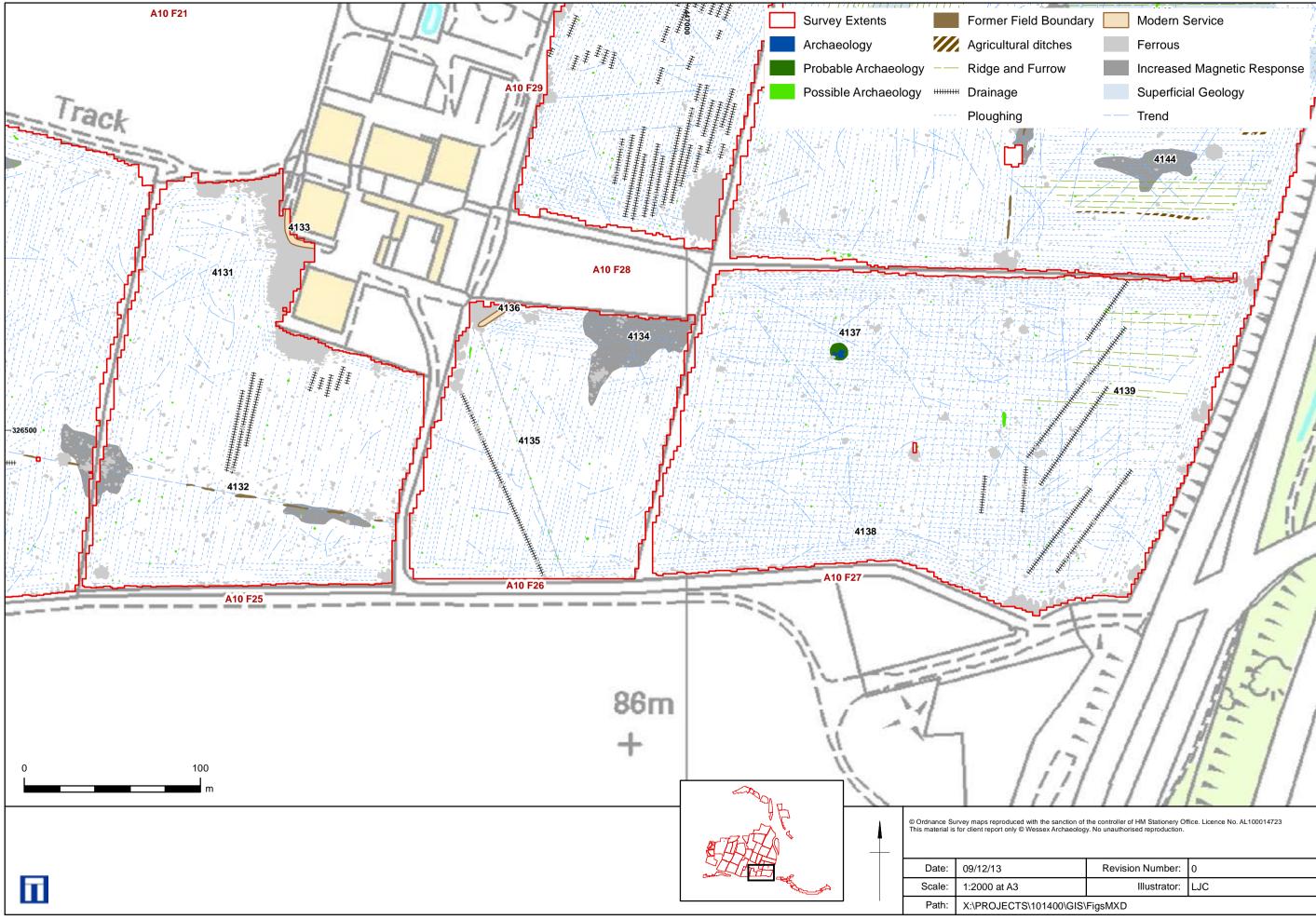




Greyscale: Fields A10 F25 to A10 F27

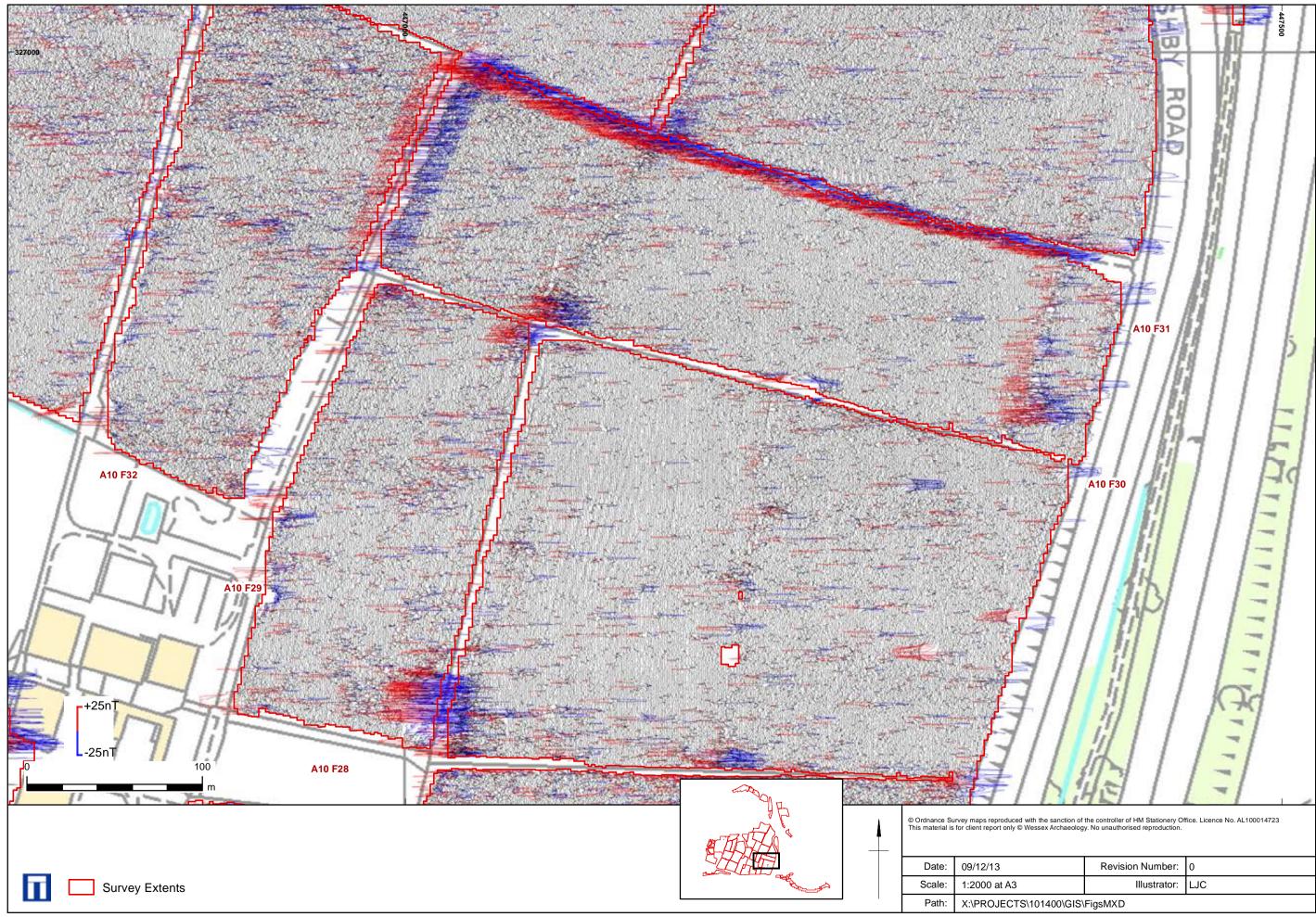


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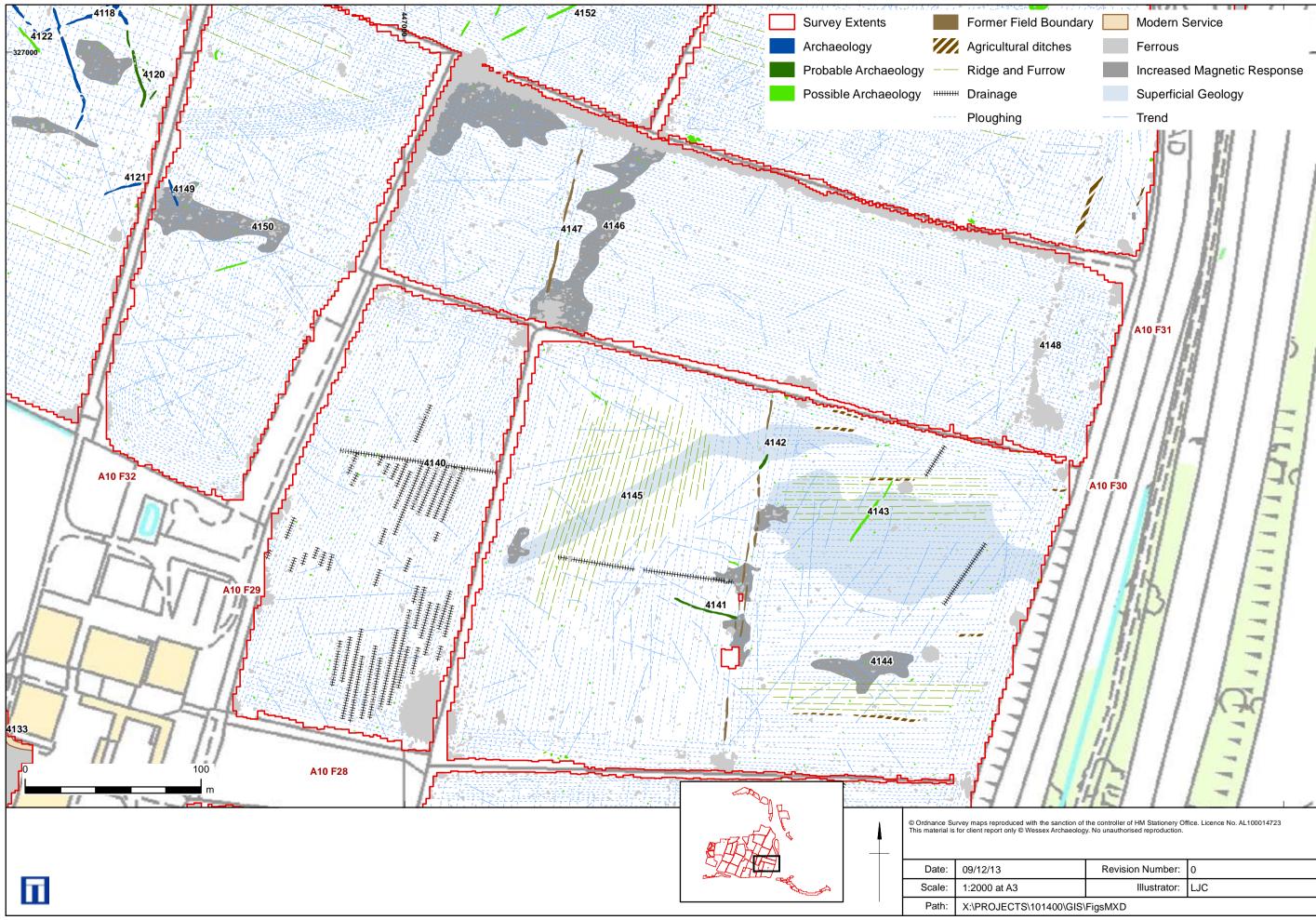


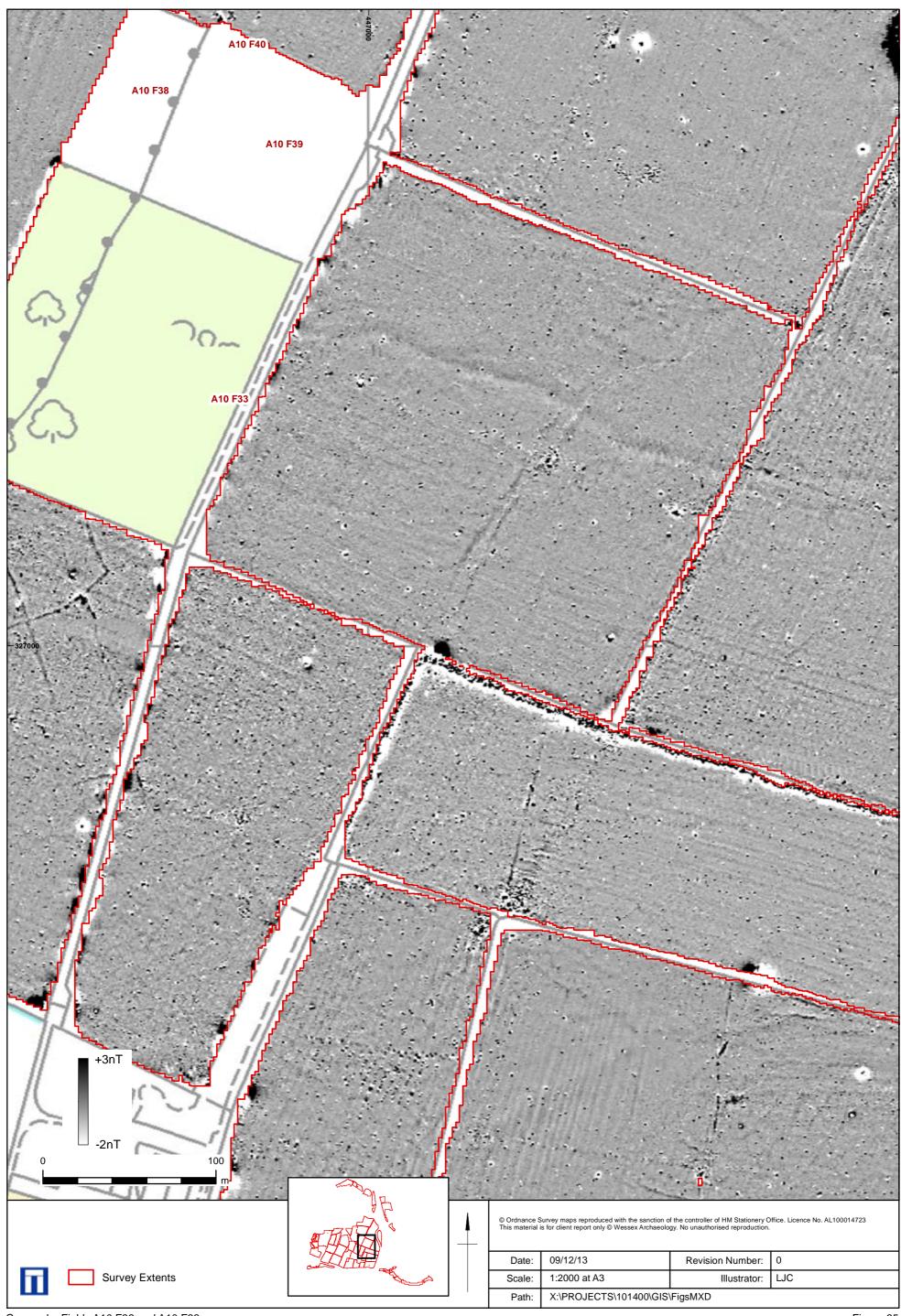


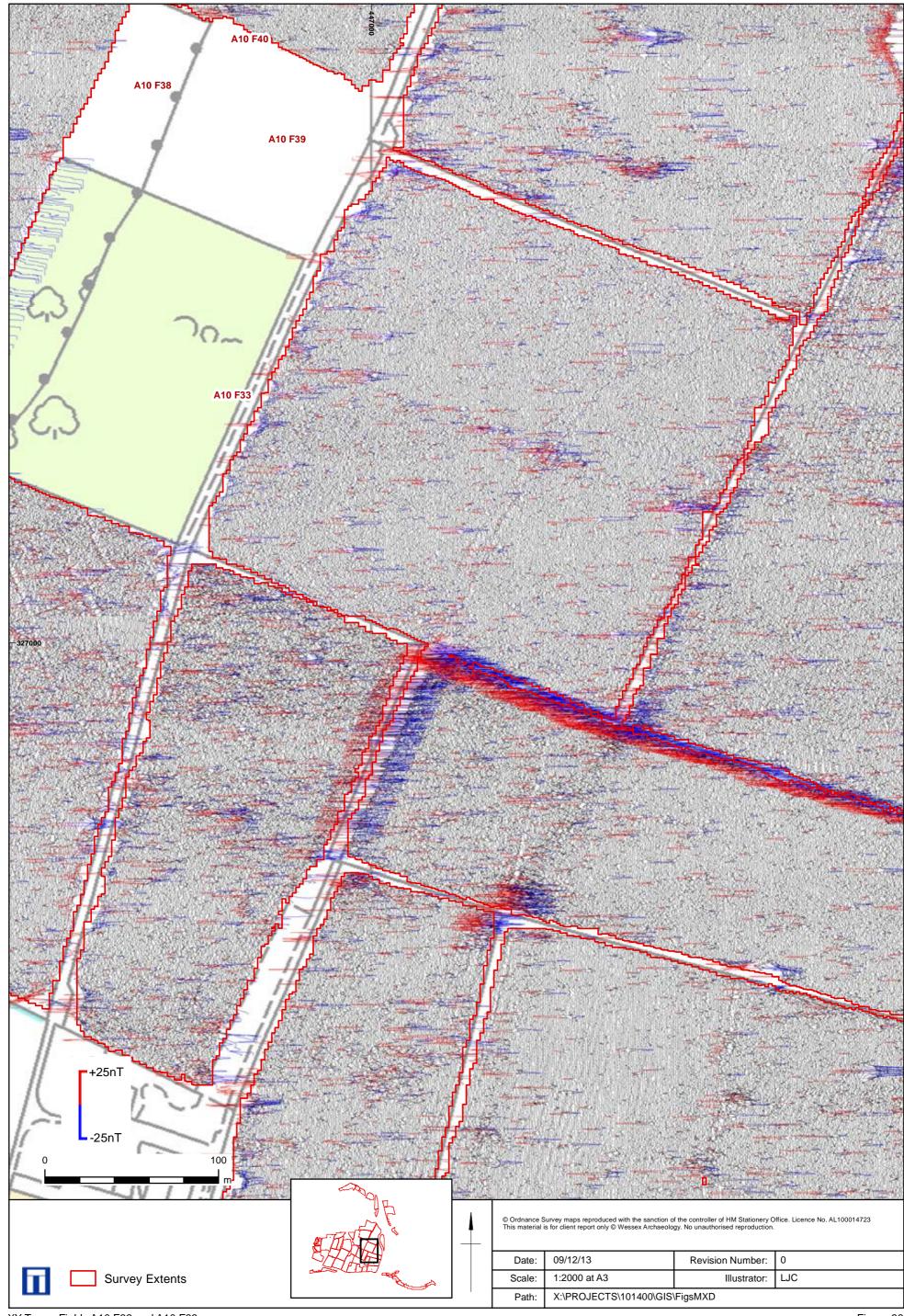
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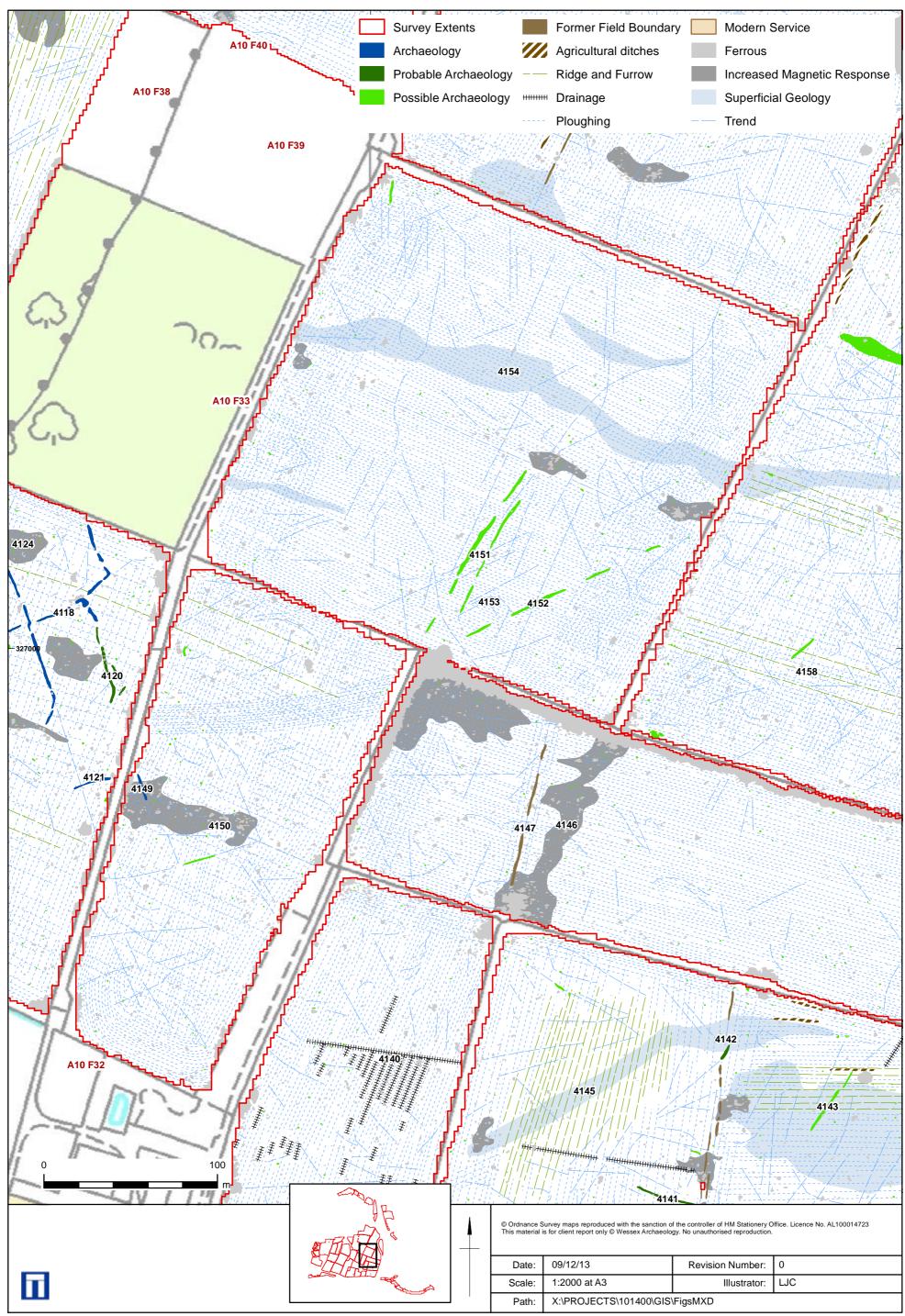


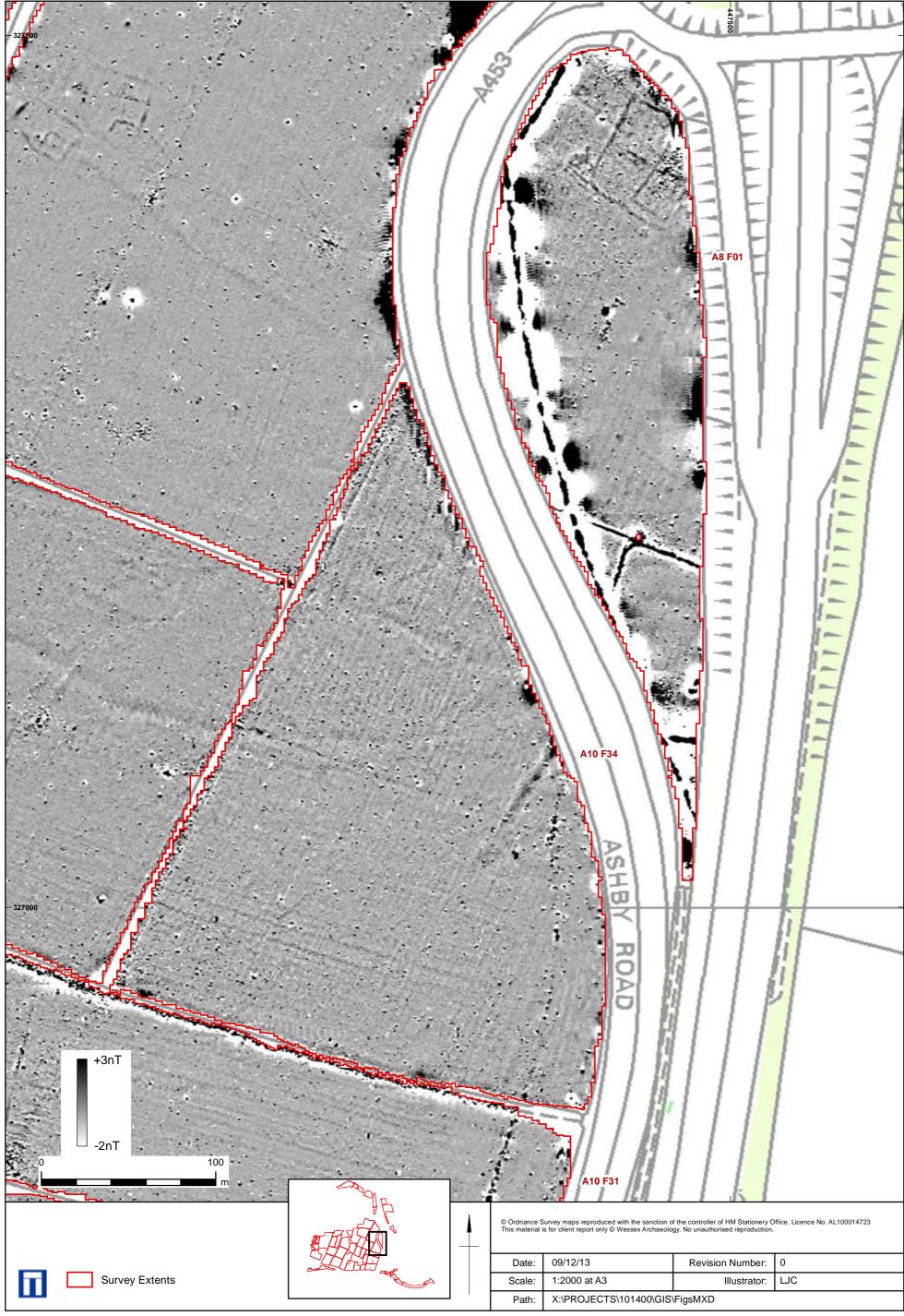
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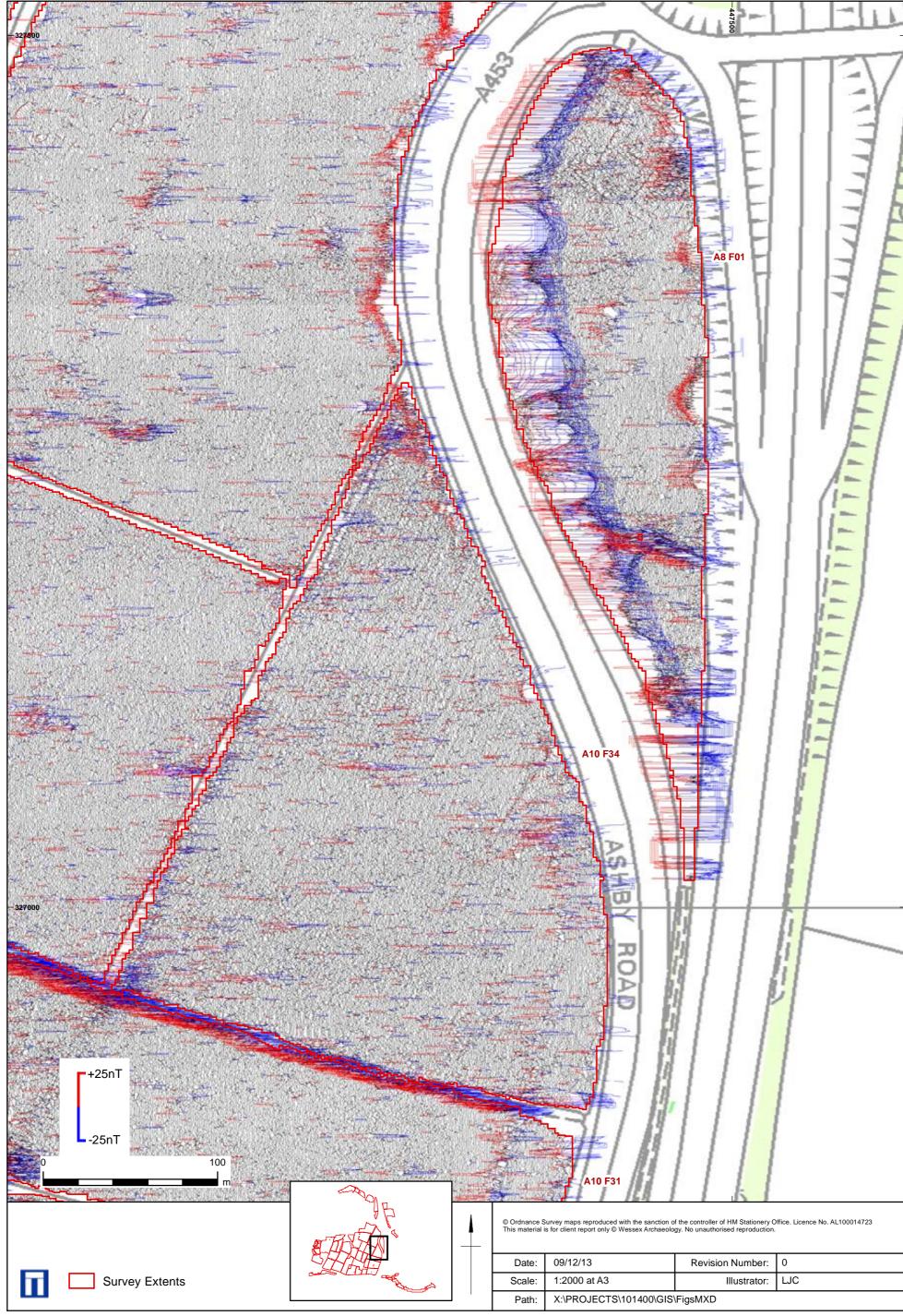


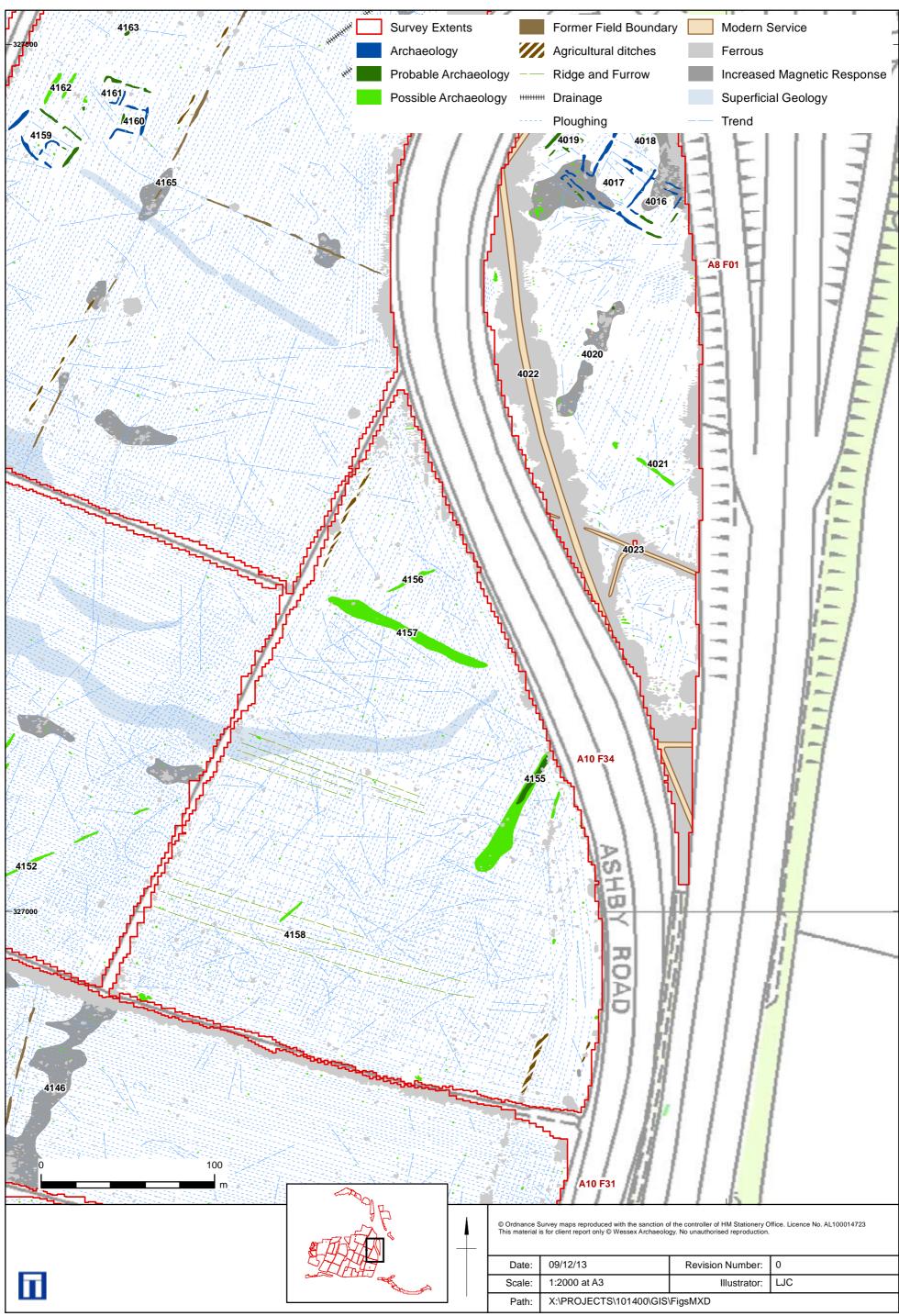


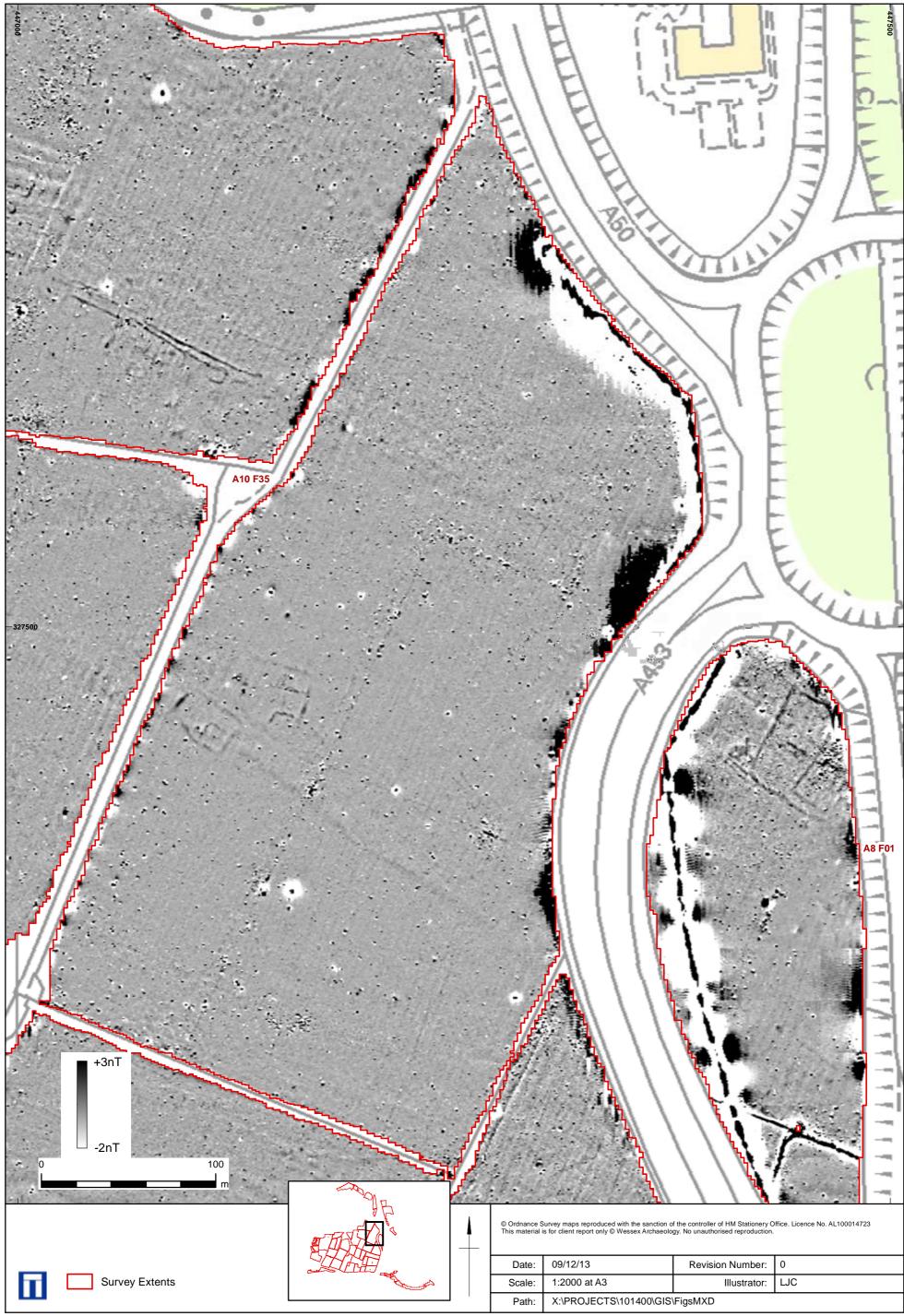




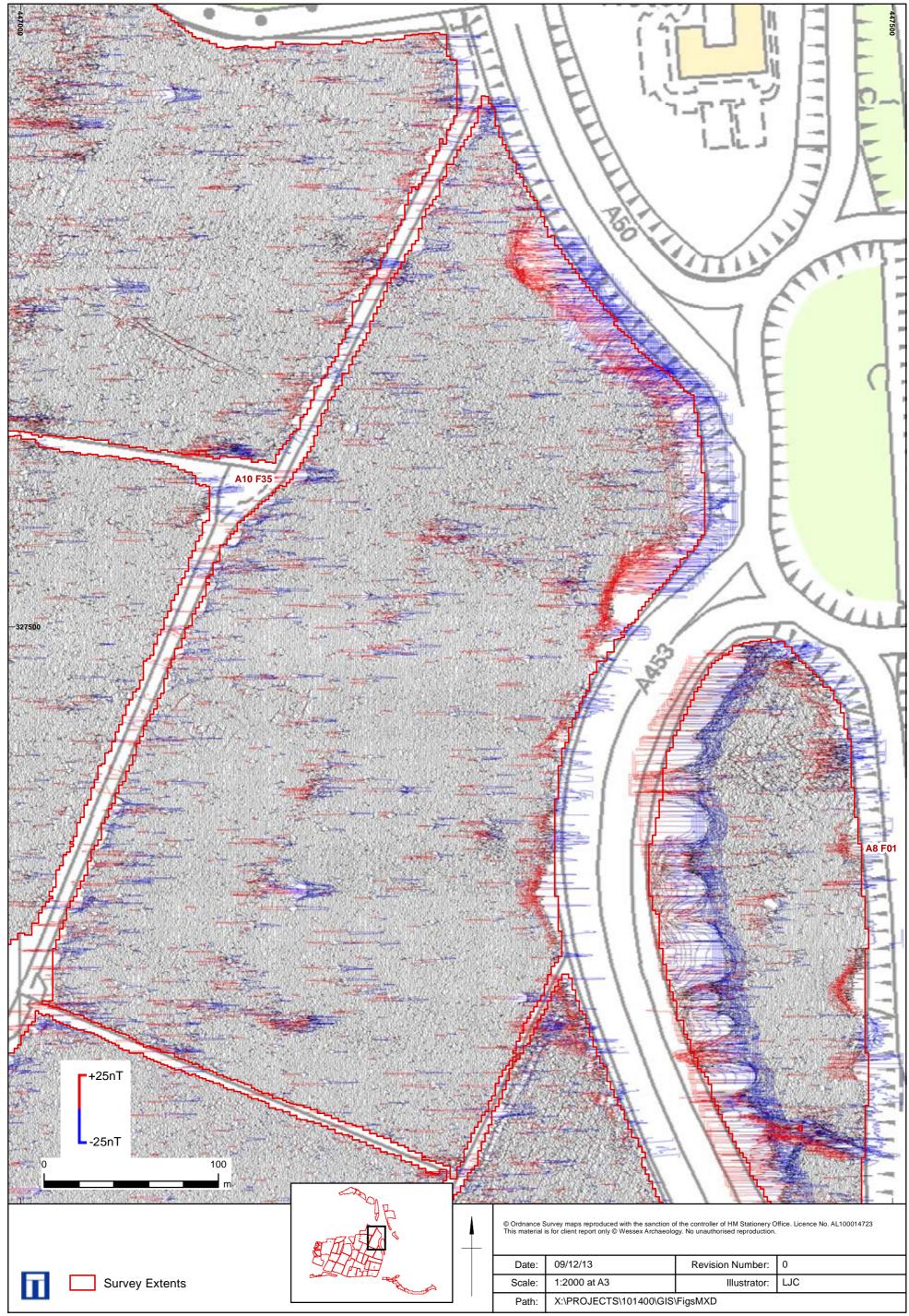


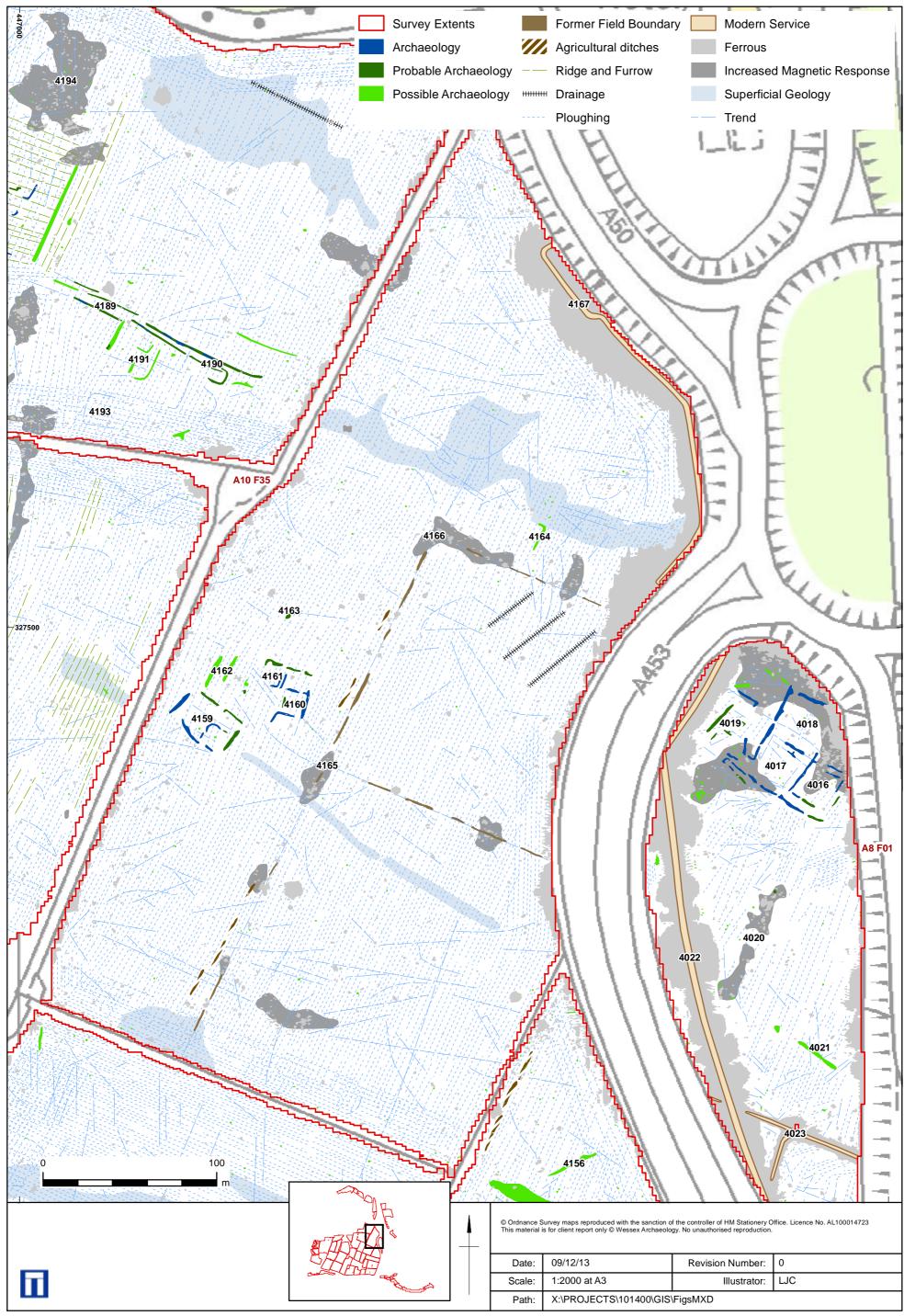


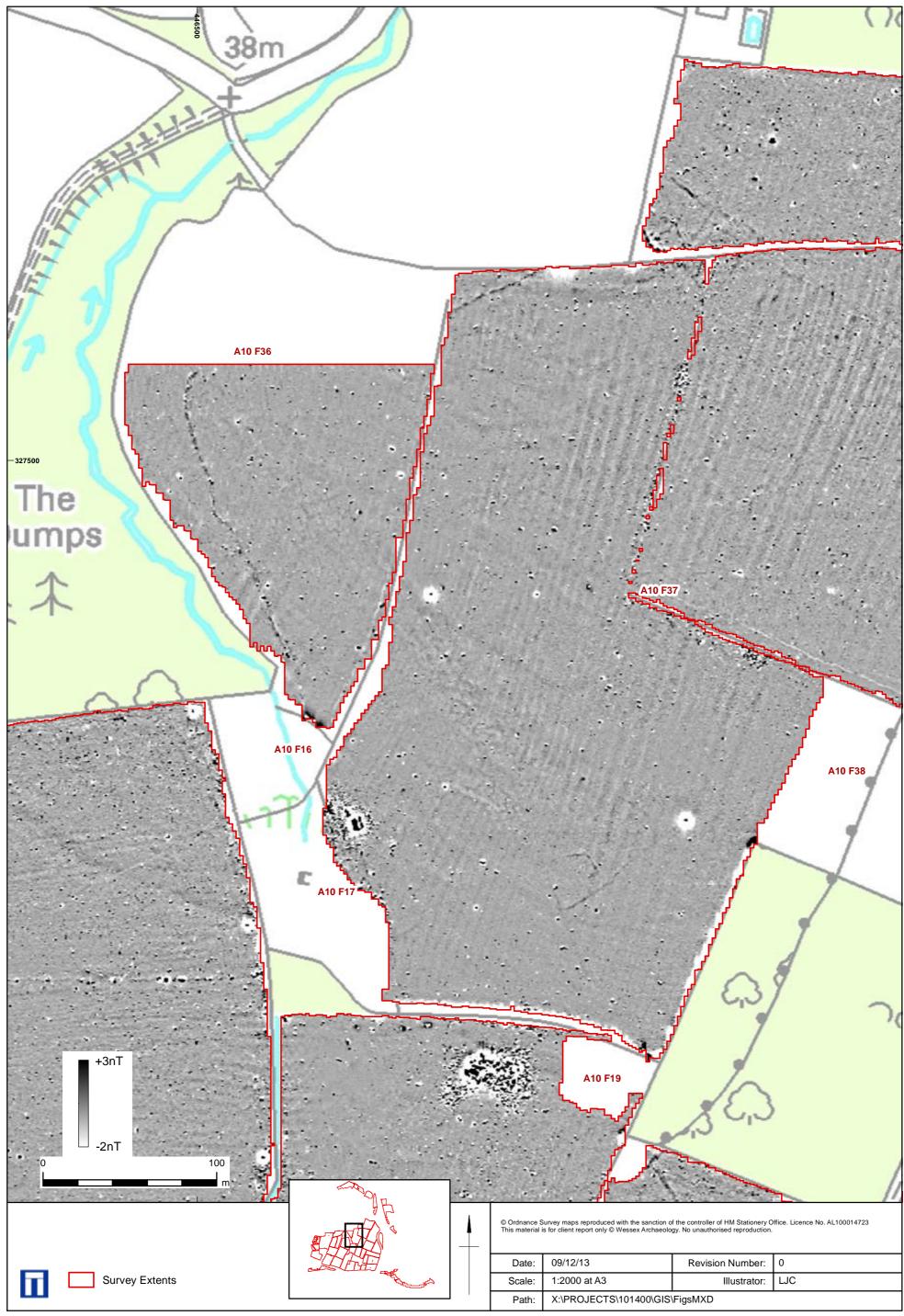


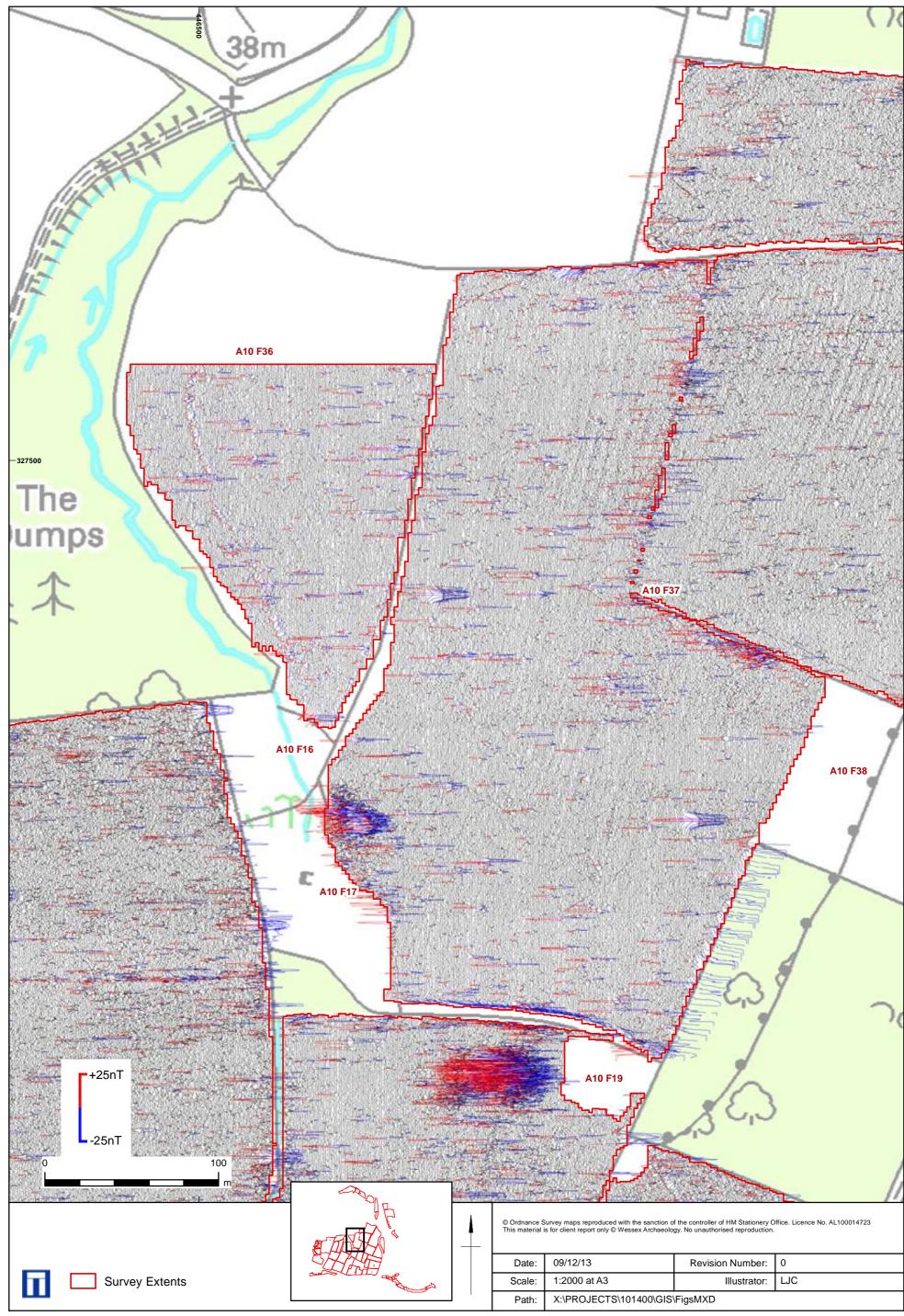


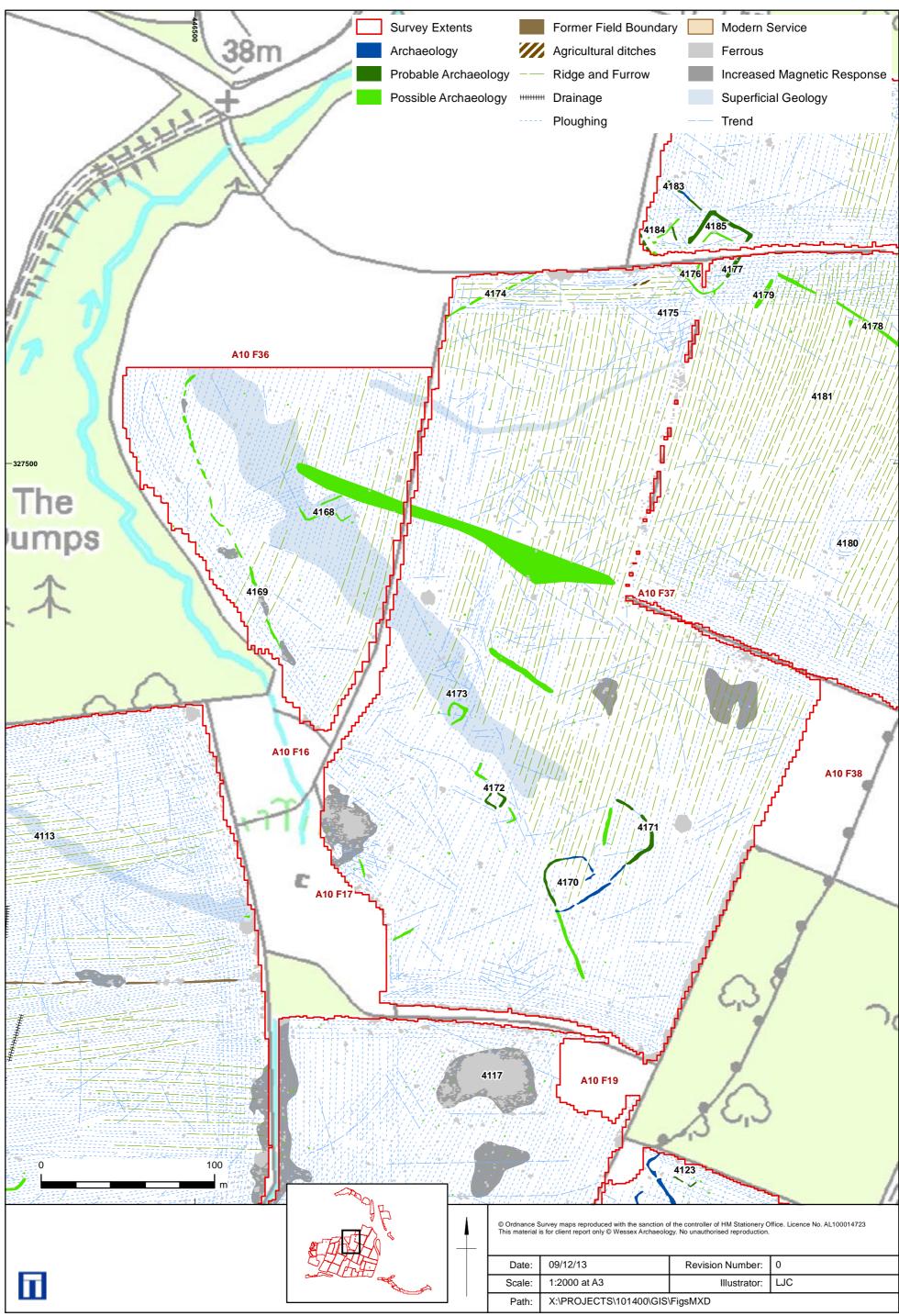
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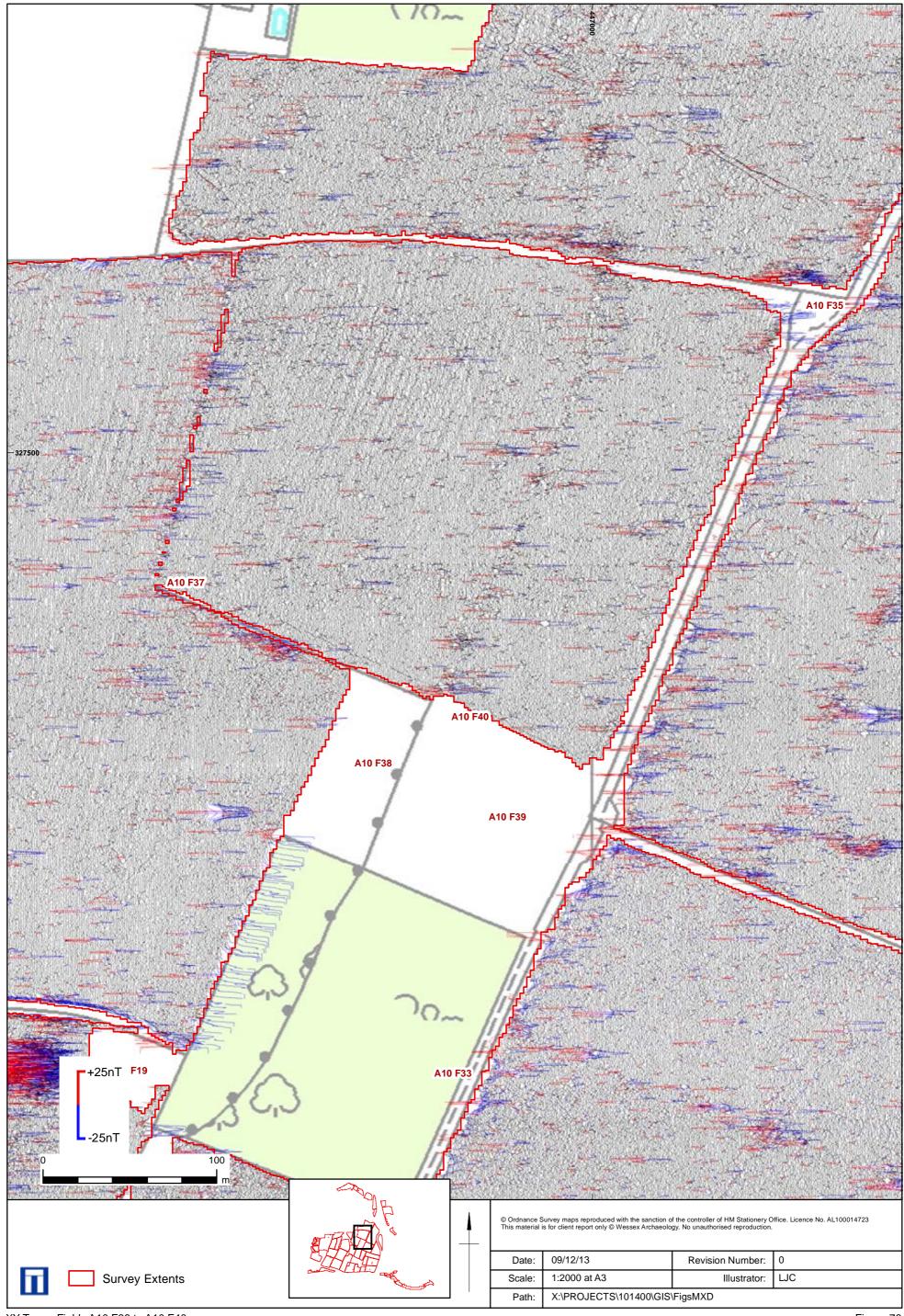


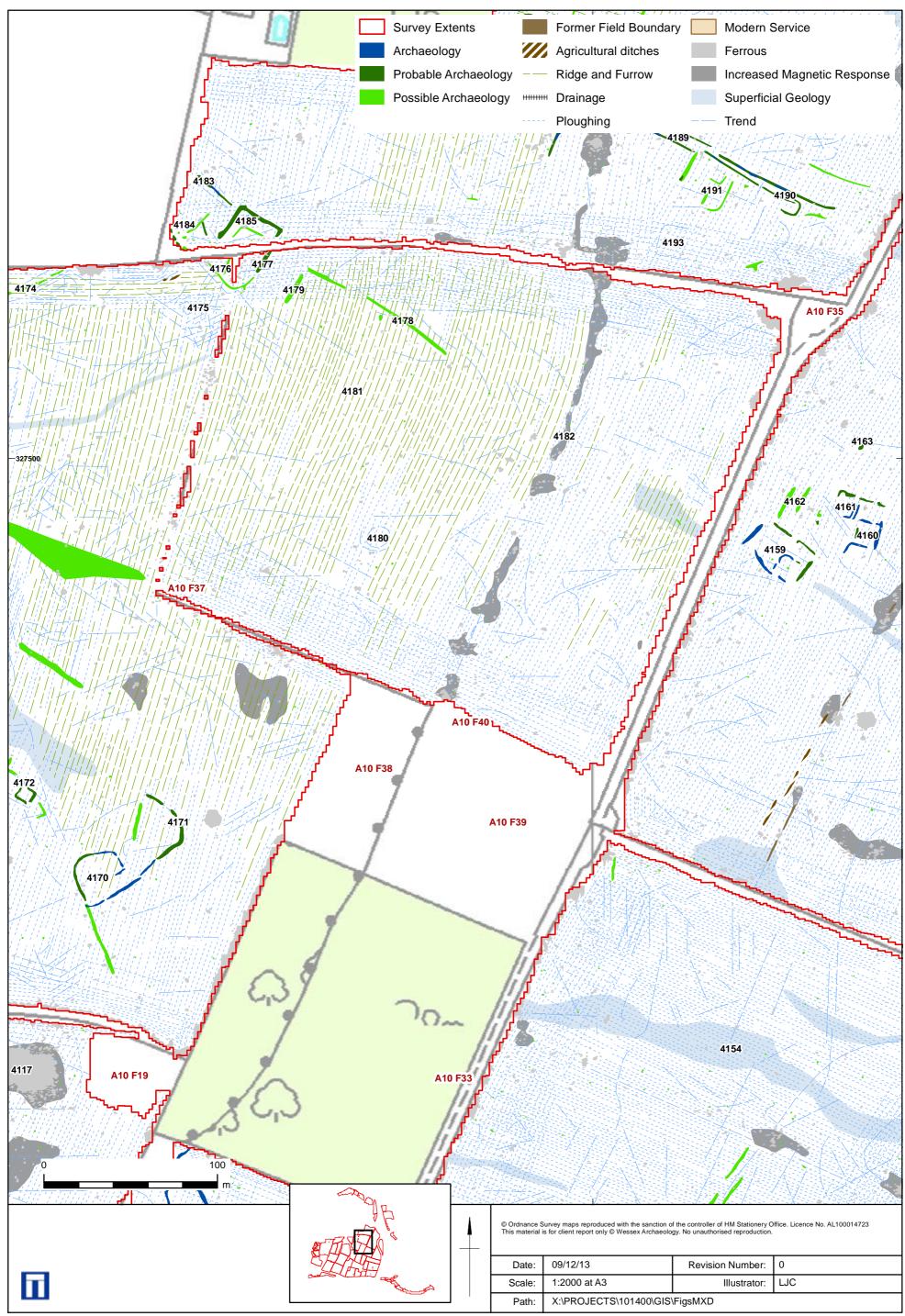


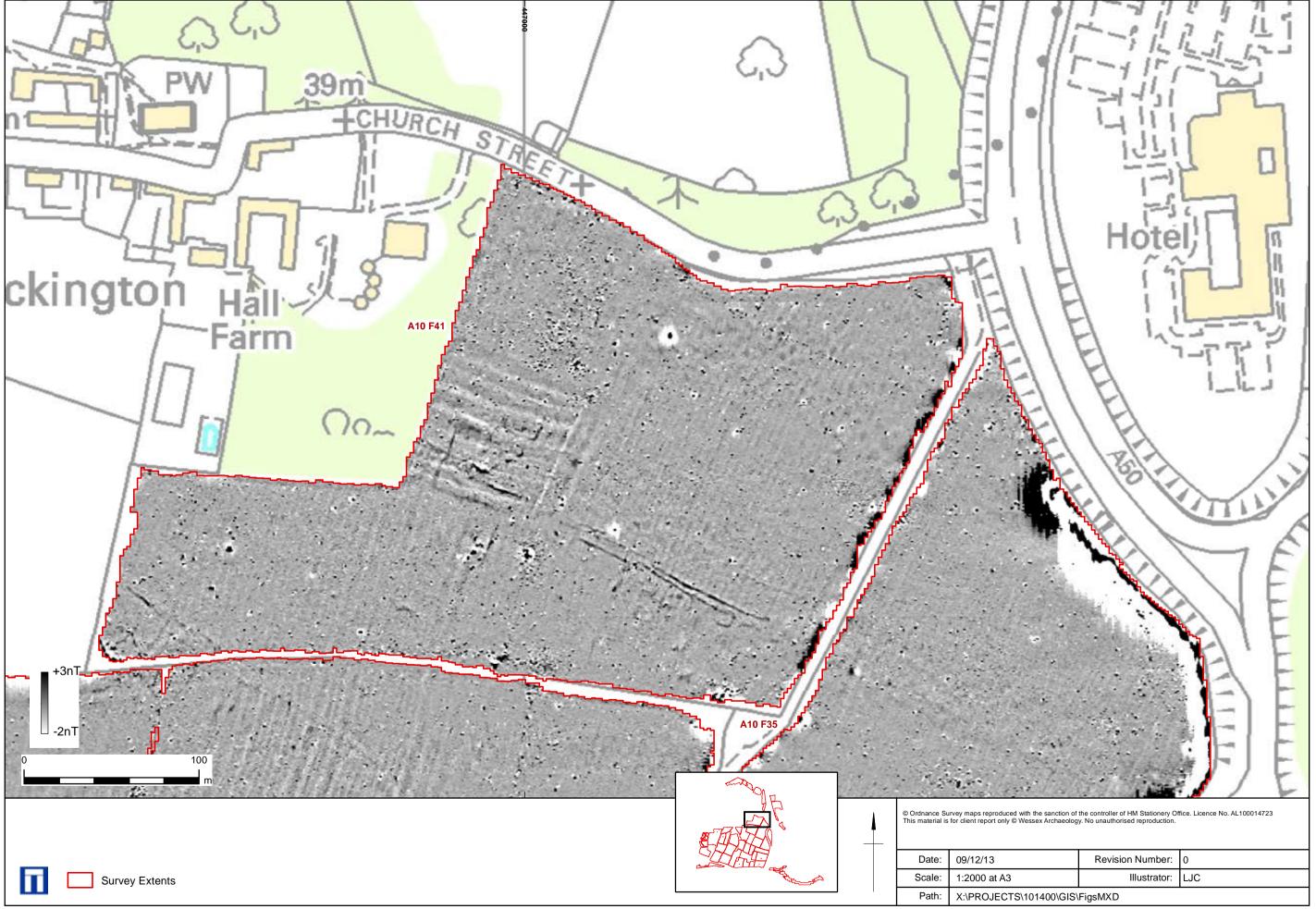




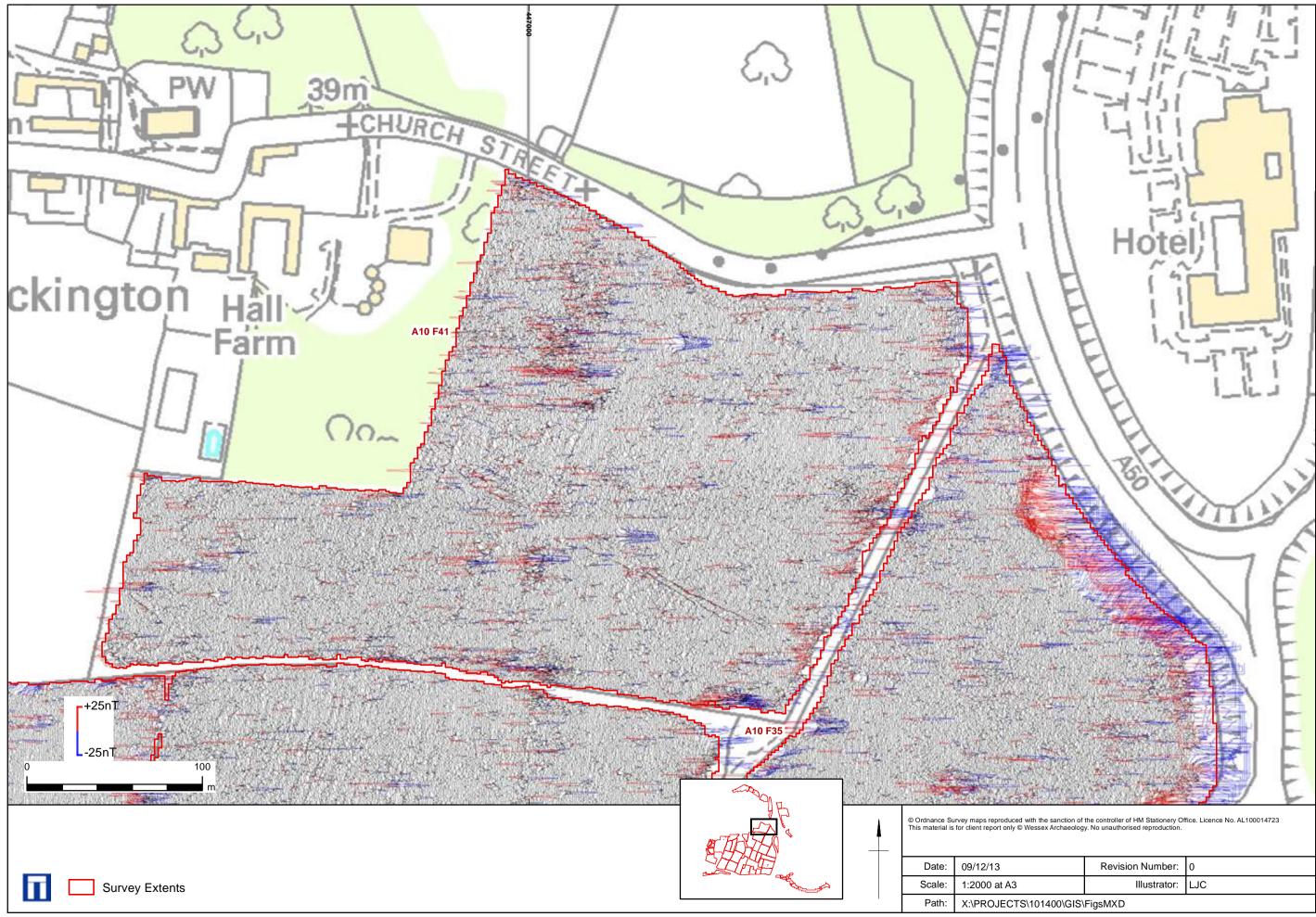




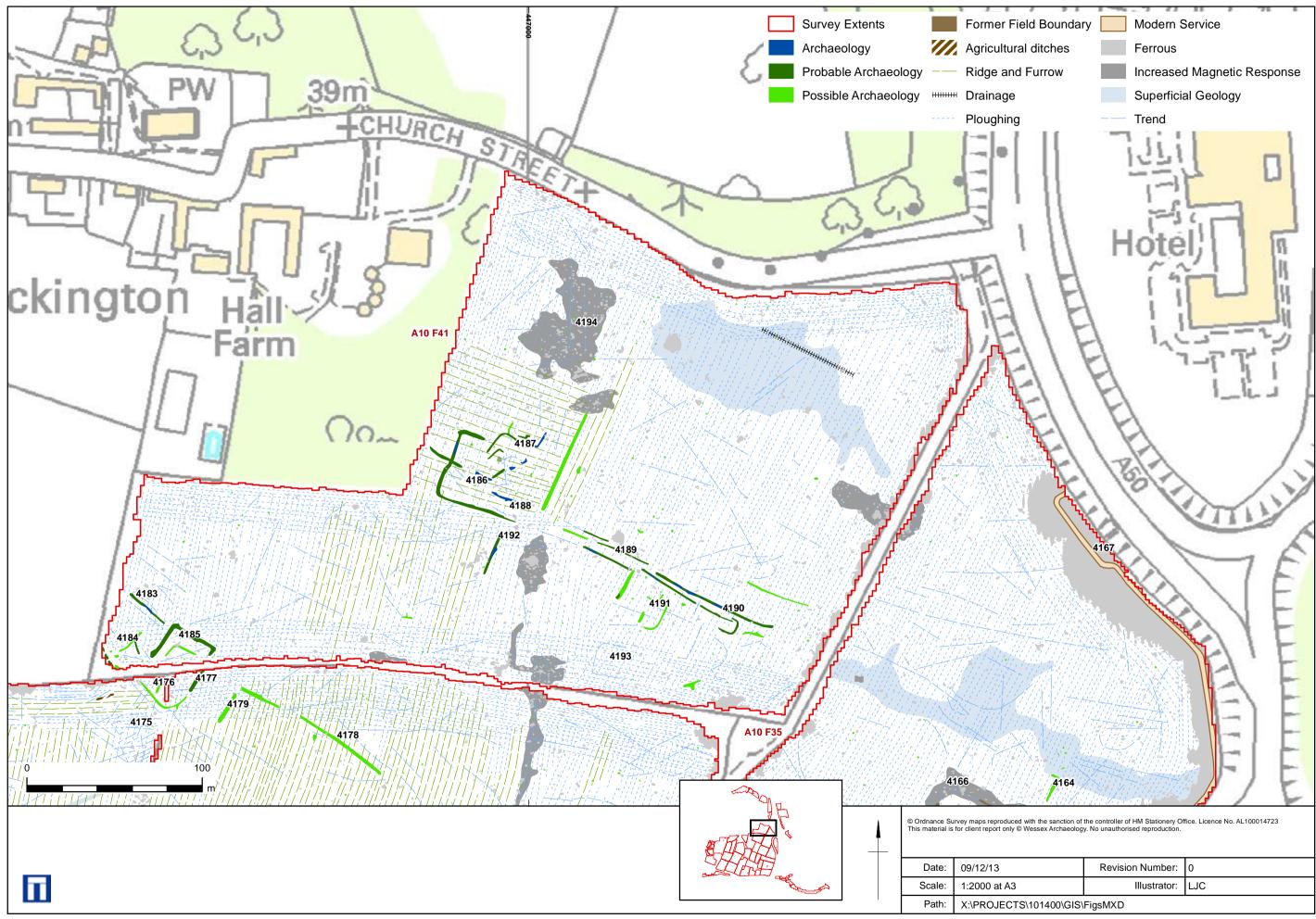


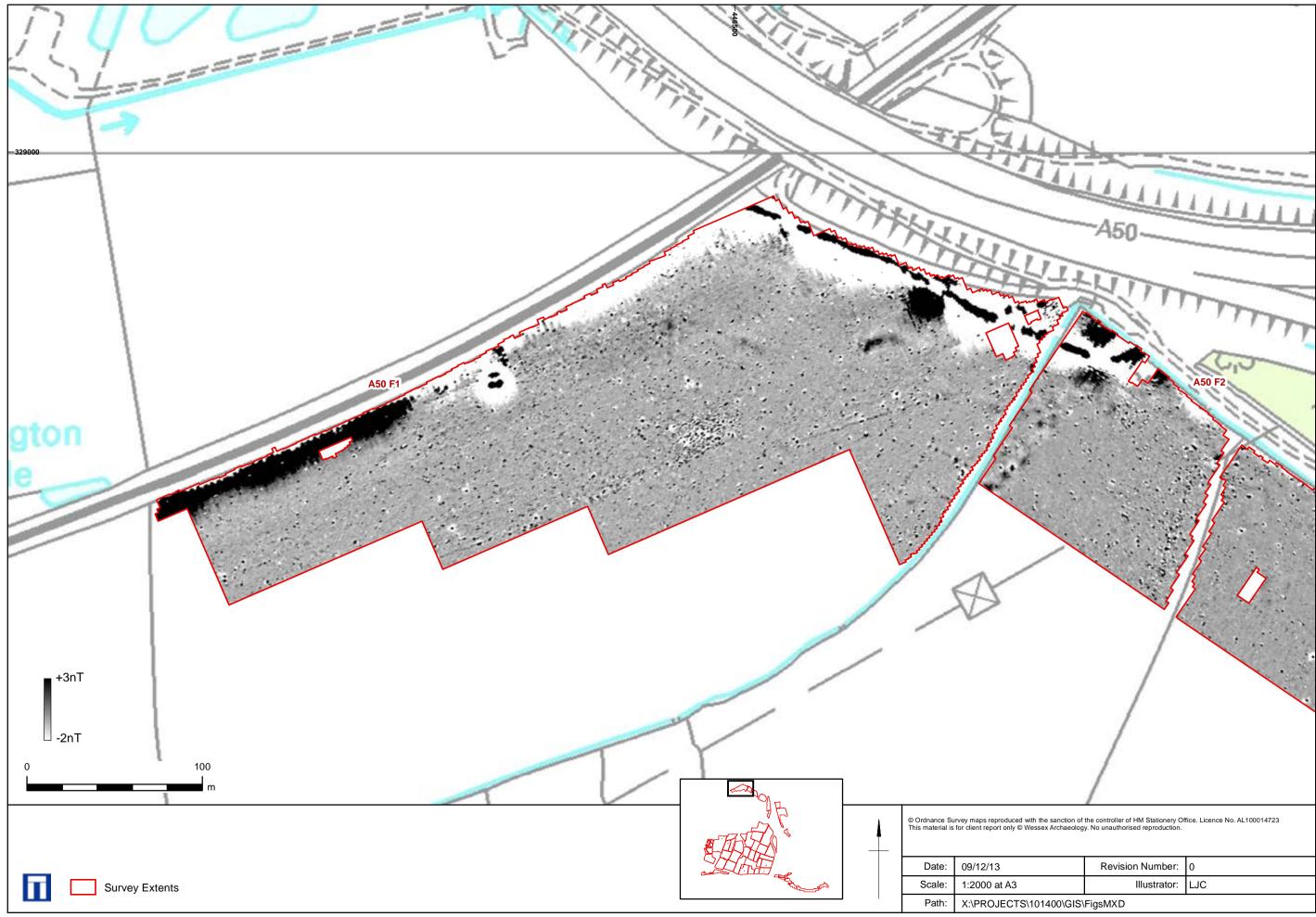


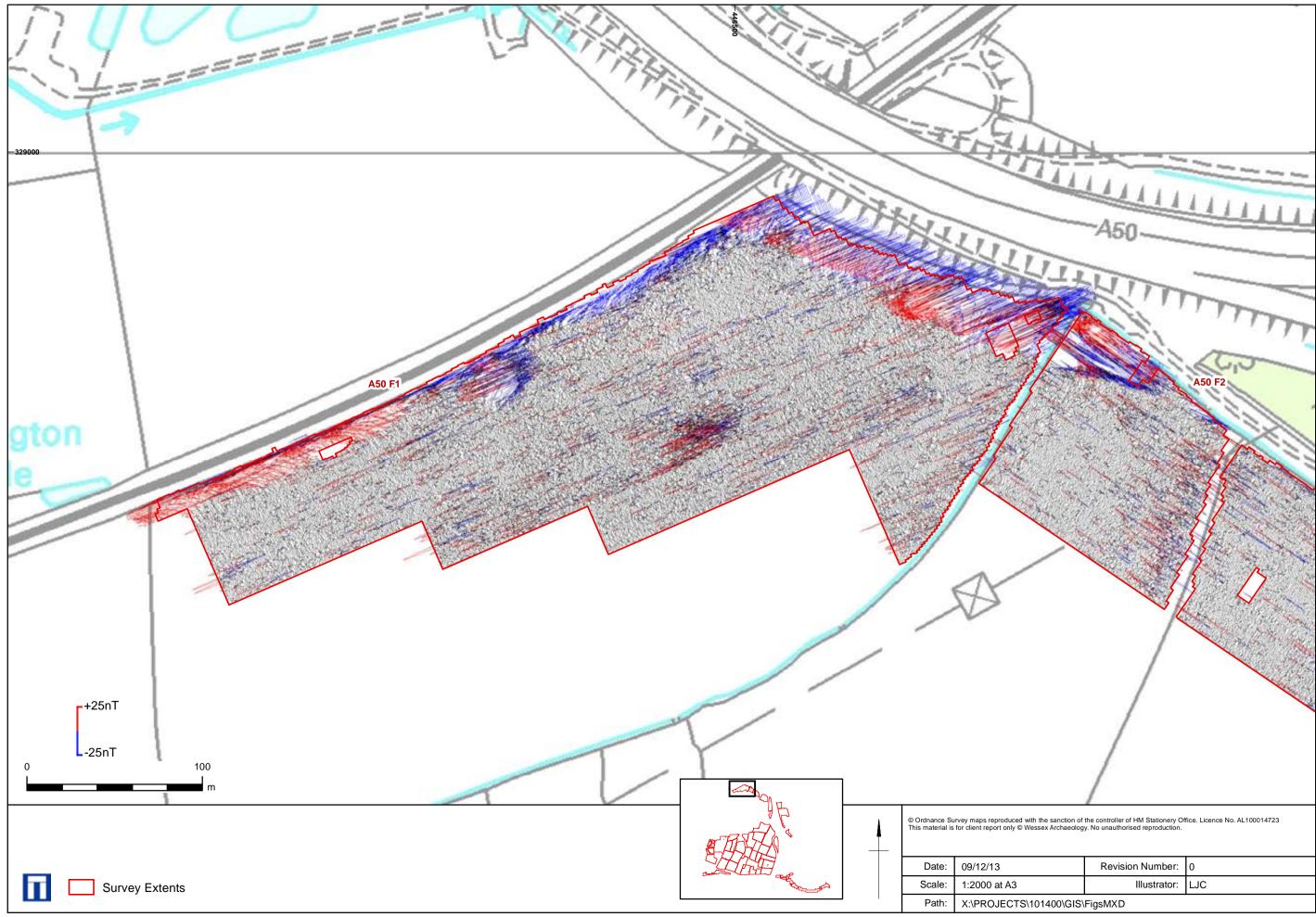
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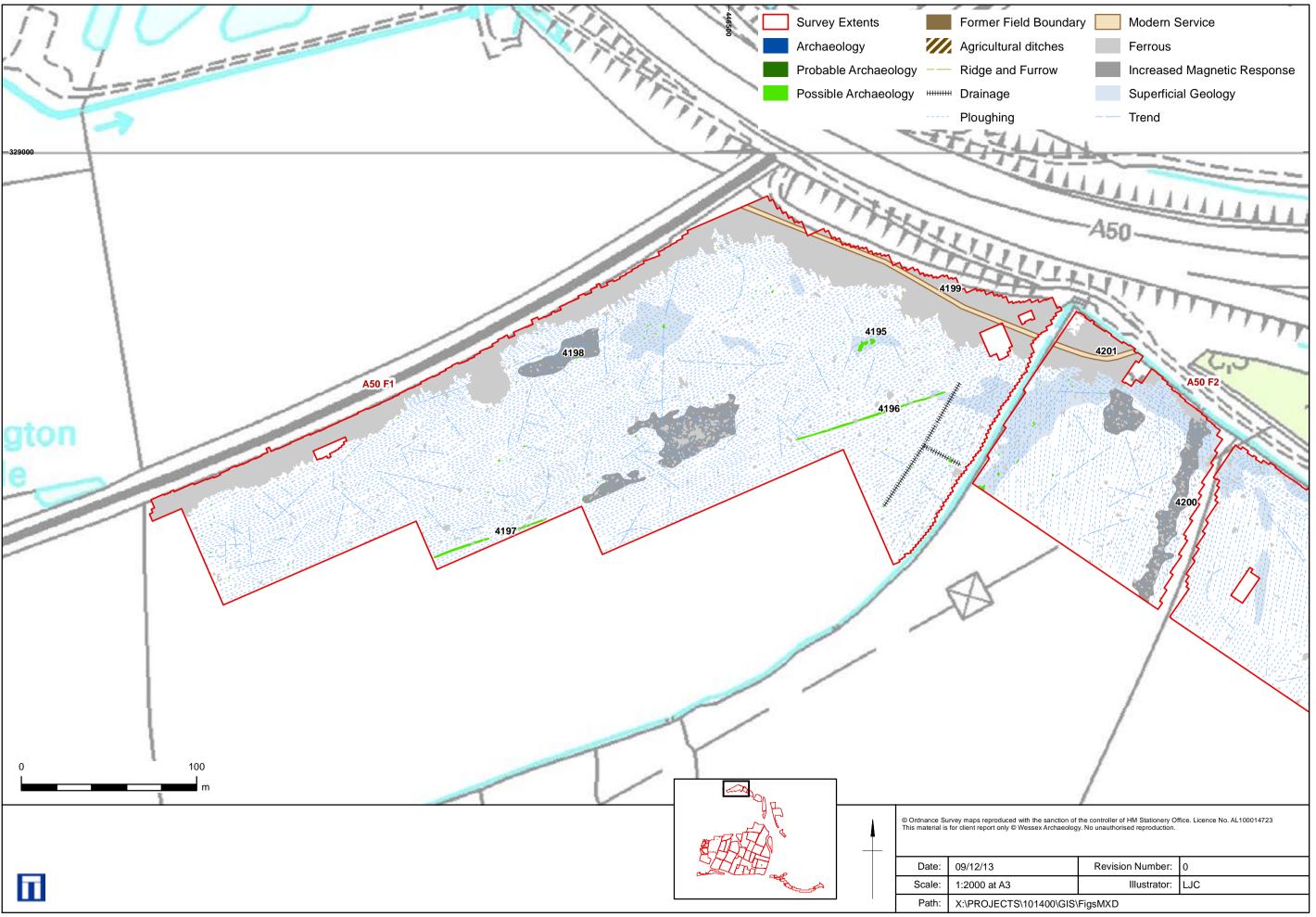


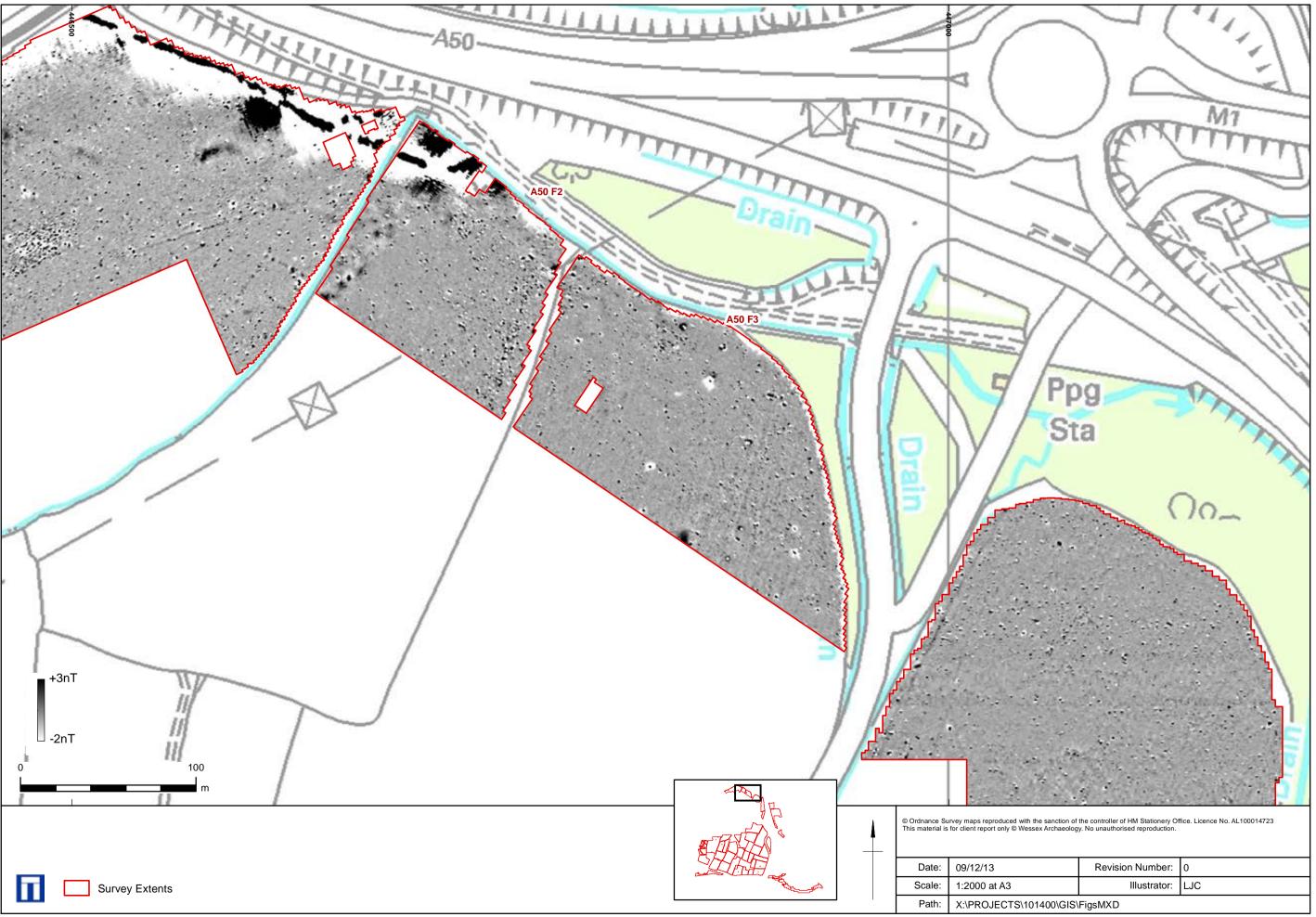
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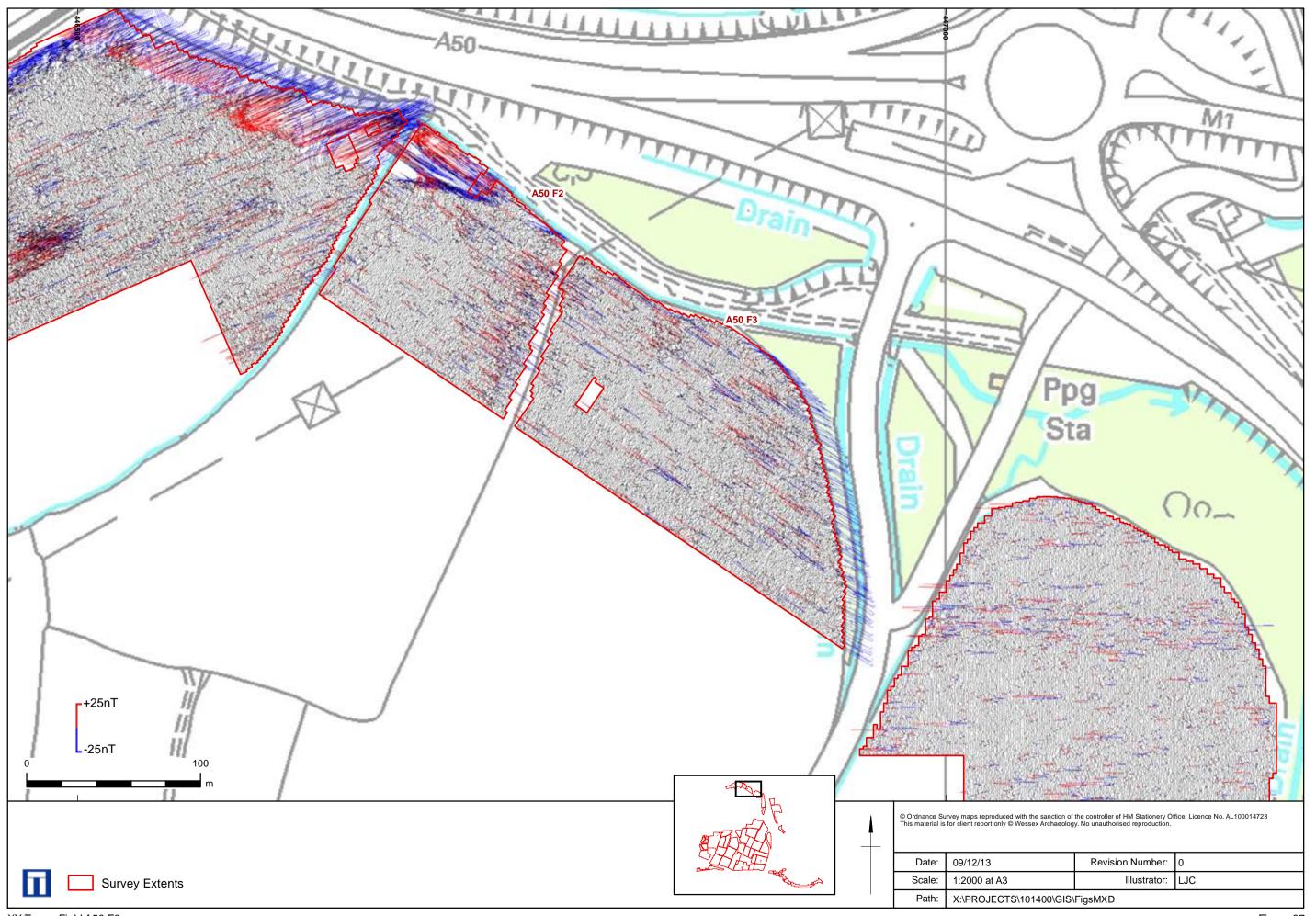












XY Trace: Field A50 F3

