Appendices to Chapter K
Archaeology

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Appendix K1
Archaeological Desk Based Assessment

CgMs HERITAGE

PART OF RPS

ARCHAEOLOGICAL DESK BASED ASSESSMENT

Land North East of Milton Keynes

March 2021

Planning Authority:
Milton Keynes Council

Site centred at:
SP 89360 41790

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EXECUTIVE SUMMARY

- Land North East of Milton Keynes has been allocated for comprehensive development in the Milton Keynes Local Plan 2019. Therefore, in accordance with relevant government planning policy and guidance, a desk based assessment has been undertaken to clarify the below ground archaeological potential of the study area.

- In terms of relevant designated archaeological assets, no designated World Heritage Sites, Scheduled Monuments, Historic Battlefield sites or Historic Wreck sites lie within the vicinity of the study site.

- This archaeological desk based assessment has identified that the site retains a low to moderate archaeological potential for the Palaeolithic period, and a low potential for Mesolithic evidence. A generally low to moderate potential is identified for Neolithic and Bronze Age artefactual evidence, whilst a specific potential associated with Bronze Age ring ditches is anticipated. A generally low to moderate archaeological potential is considered across the study site for isolated Iron Age and Roman agricultural activity, whilst a specific potential is identified in areas associated with occupation identified by geophysical survey and also associated with the projected alignment of a Roman road. A generally low potential is suggested for Saxon and Medieval occupation/settlement activity, with specific areas of high potential as identified by geophysical survey, and a moderate potential for agricultural activity and land division. A low potential is identified for the Post Medieval and Modern periods, with a specific potential anticipated within areas of modern development. A palaeoenvironmental potential associated with the alluvial deposits of the River Ouzel is also anticipated. Any below ground archaeological assets which may be present would most likely be of local to regional significance, although the remains of a currently undated fortified enclosure could be of a regional to national significance.

- In addition, this assessment has identified that the area of the study site to the east of the London Road comprises a well-preserved Parliamentary enclosed landscape. Further work comprising an Historic Landscape/Hedgerow Assessment is suggested as part of any application for development.

- Past impacts are generally limited to specific areas of modern development and extraction activity, although past agricultural/horticultural land use will have had a moderate but widespread archaeological impact across the study site since at least the Medieval period.

- There are no nationally designated archaeological assets within the site or in close proximity. Therefore, from an archaeological perspective, it is considered that the site is viable for development, and that any adverse impacts on archaeological remains can be satisfactorily addressed through appropriate archaeological mitigation measures comprising preservation by record or preservation in situ as appropriate.

- Consequently, the archaeological works which are likely to be required at the site by the archaeological advisor to Milton Keynes Council to support any future planning application are as follows:

    - An Historic Landscape/Hedgerow Assessment;

    - Geoarchaeological deposit modelling of the River Ouzel valley to assess the palaeoenvironmental potential of the alluvial sequence;

    - Targeted archaeological trial trenching on any areas of archaeological potential identified within the desk based assessment, the geophysical survey and the geoarchaeological deposit modelling.

1.0 INTRODUCTION AND SCOPE OF STUDY

1.1 This updated below ground archaeological desk-based assessment has been researched and prepared by CgMs Heritage (part of the RPS Group) on behalf of Berkeley Strategic Land Limited.

1.2 The subject of this assessment, also known as the study site, is Land North East of Milton Keynes. The site is approximately 362ha in extent and is centred at SP 89360 41790 (Fig. 1) within the Borough of Milton Keynes.

1.3 The study site has been allocated for comprehensive development in the Milton Keynes Local Plan 2019. Accordingly, Berkeley Strategic Land Limited has commissioned CgMs Heritage (Part of the RPS Group) to establish the archaeological potential of the site and to provide guidance on ways to address any archaeological constraints identified.

1.4 In accordance with relevant policy and guidance on archaeology and planning, and in accordance with the 'Standard and Guidance for Historic Environment Desk-Based Assessments' (Chartered Institute for Archaeologists October 2020), this assessment draws together the available archaeological, topographic and land-use information in order to clarify the archaeological potential of the site.

1.5 This desk-based assessment comprises an examination of evidence on the Milton Keynes Historic Environment Record (HER), the Historic England National Monuments Record (NMR) and other sources, and includes the results of a comprehensive map regression exercise. The results of comprehensive geophysical survey have been worked into this assessment as appropriate. No National Mapping Programme (NMP Cropmark) data is available for the study site per consultation with Historic England.

1.6 This assessment addresses below ground archaeological assets only and does not address any built heritage issues.

1.7 The Assessment thus enables relevant parties to assess the archaeological potential of various parts of the site and to consider the need for design, civil engineering, and archaeological solutions to the archaeological potential identified.

2.0 PLANNING BACKGROUND AND DEVELOPMENT PLAN FRAMEWORK

2.1 National legislation regarding archaeology, including scheduled monuments, is contained in the Ancient Monuments and Archaeological Areas Act 1979, amended by the National Heritage Act 1983 and 2002, and updated in April 2014.

2.2 In March 2012, the government published the National Planning Policy Framework (NPPF), which was most recently revised in June 2019. The NPPF is supported by the National Planning Practice Guidance (NPPG), which was published online 6th March 2014 and has since been periodically updated.

2.3 The NP NPPF and NPPG are additionally supported by three Good Practice Advice (GPA) documents published by Historic England: GPA 1: The Historic Environment in Local Plans; GPA 2: Managing Significance in Decision-Taking in the Historic Environment (both published March 2015). The second edition of GPA3: The Setting of Heritage Assets was published in December 2017.

National Planning Policy

2.4 Section 16 of the NPPF, entitled 'Conserving and Enhancing the Historic Environment' provides guidance for planning authorities, property owners, developers and others on the conservation and investigation of heritage assets. Overall, the objectives of Section 16 of the NPPF can be summarised as seeking the:

- Delivery of sustainable development;
- Understanding the wider social, cultural, economic and environmental benefits brought by the conservation of the historic environment;
- Conservation of England's heritage assets in a manner appropriate to their significance; and
- Recognition of the contribution that heritage makes a contribution towards our knowledge and understanding of the past.

2.5 Section 16 of the NPPF recognises that intelligently managed change may sometimes be necessary if heritage assets are to be maintained for the long term. Paragraph 189 states that planning decisions should be based on the significance of the heritage asset and that the level of detail supplied by an applicant should be proportionate to the importance of the asset and should be no more than sufficient to review the potential impact of the proposal upon the significance of that asset.

2.6 *Heritage Assets* are defined in Annex 2 of the NPPF as: a building, monument, site, place, area or landscape identified as having a degree of significance meriting consideration in planning decisions, because of its heritage interest. It includes designated heritage assets and assets identified by the local planning authority (including local listing).

2.7 Annex 2 also defines *Archaeological Interest* as a heritage asset which holds, or potentially holds, evidence of past human activity worthy of expert investigation at some point.

2.8 A *Nationally Important Designated Heritage Asset* comprises a: World Heritage Site, Scheduled Monument, Listed Building, Protected Wreck Site, Registered Park and Garden, Registered Battlefield or Conservation Area designated under the relevant legislation.

2.9 *Significance* is defined as: The value of a heritage asset to this and future generations because of its heritage interest. This interest may be archaeological, architectural, artistic or historic. Significance derives not only from a heritage asset's physical presence, but also from its setting.

2.10 *Setting of a heritage asset* is defined as: The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral.

2.11 In short, government policy provides a framework which:

- Protects nationally important designated Heritage Assets;
- Protects the settings of such designations;
- In appropriate circumstances seeks adequate information (from desk based assessment and field evaluation where necessary) to enable informed decisions;
- Provides for the excavation and investigation of sites not significant enough to merit *in-situ* preservation.

2.12 The NPPG reiterates that the conservation of heritage assets in a manner appropriate to their significance is a core planning principle, requiring a flexible and thoughtful approach. Furthermore, it highlights that neglect and decay of heritage assets is best

addressed through ensuring they remain in active use that is consistent with their conservation. Importantly, the guidance states that if complete, or partial loss of a heritage asset is justified, the aim should then be to capture and record the evidence of the asset's significance and make the interpretation publicly available. Key elements of the guidance relate to assessing harm. An important consideration should be whether the proposed works adversely affect a key element of the heritage asset's special architectural or historic interest. Additionally, it is the degree of harm, rather than the scale of development, that is to be assessed. The level of 'substantial harm' is considered to be a high bar that may not arise in many cases. Essentially, whether a proposal causes substantial harm will be a judgment for the decision taker, having regard to the circumstances of the case and the NPPF. Importantly, harm may arise from works to the asset or from development within its setting. Setting is defined as the surroundings in which an asset is experienced and may be more extensive than the curtilage. A thorough assessment of the impact of proposals upon setting needs to take into account, and be proportionate to, the significance of the heritage asset and the degree to which proposed changes enhance or detract from that significance and the ability to appreciate it.

2.13 In considering any planning application for development, the planning authority will be mindful of the framework set by government policy, in this instance the NPPF, by current Development Plan Policy and by other material considerations.

Local Planning Policy

2.14 The site is located within the Borough of Milton Keynes, which adopted its Local Plan on 20th March 2019. The Plan is known as "Plan:MK" and now forms part of the Council's development plan, replacing the Core Strategy (2013) and the saved policies of the previous 2005 Local Plan.

2.15 The following policies are contained within Plan:MK that are relevant to archaeology across the Borough, including the study site:

Policy HE1
HERITAGE AND DEVELOPMENT

A. Proposals will be supported where they sustain and, where possible, enhance the significance of heritage assets which are recognised as being of historic, archaeological, architectural, artistic, landscape or townscape significance. These heritage assets include:

1. **Listed Buildings;**
2. **Conservation Areas;**
3. **Scheduled Ancient Monuments and non-designated Archaeological sites;**
4. **Registered Parks and Gardens;**
5. **Assets on the MK New-Town Heritage Register; and**
6. **Other places, spaces, structures and features which may not be formally designated but considered to meet the definition of 'heritage assets' as defined in Annex 2 of the NPPF.**

B. Where appropriate, development proposals must provide an impartial and objective heritage assessment. Where necessary, the Council will require suitably qualified specialists to undertake the heritage assessment. The heritage assessment shall:

1. **Assess and describe the significance of the heritage assets affected, identifying those elements that contribute to that significance and, where appropriate, those that do not. The level of detail shall be proportionate to the asset's importance and no more than is sufficient to understand the potential impact of proposals on their significance. Limited and localised alterations to an unlisted building in a conservation area need not be supported by the level of detail required to convey the impact on significance caused by development in the setting of a listed building or by proposed alterations to the built fabric of a listed building.**
2. **Be of an analytical and interpretive nature rather than simply provide a description of the assets and the proposed works.**
3. **Provide a sound justification for the works, based on the economic, social and environmental benefits delivered by the scheme, for example, promoting the long term care for a heritage asset and/or its setting.**
4. **Explain how the scheme has taken account of the significance of the assets in its scope, design and detail, in order to minimise or avoid harm to the heritage assets affected.**
5. **Assess the nature and extent of any harm or public benefit arising from the scheme.**
6. **Where harm is caused by the proposal, the assessment shall explain why such harm is unavoidable or required to deliver public benefits that outweigh the harm caused.**

C. Where applications seek to change the use of a listed building, evidence should be submitted to demonstrate that the proposal includes the full scope of works required to achieve that use (such as those that will be required by Building Regulations, The Fire Authority, Environmental Health etc.). Where a change of use requires a significant alteration or structural works, an engineer's report shall be submitted to demonstrate that the building is capable of conversion, set out the full extent of works and show how they have taken account of 2 a) above.

D. Granting of permission for proposals that result in substantial harm to or total loss of the significance of a designated heritage asset will only be exceptional or wholly exceptional in accordance with national policy and guidance.

E. Permission for proposals that cause less than substantial harm to a designated heritage asset will only be granted where the harm is demonstrably outweighed by public benefits delivered by the scheme.

F. Proposals that result in harm to the significance of non-designated heritage assets will be resisted unless the need for, and benefits of the development clearly outweigh the harm, taking into account the asset's significance and importance, and only once all feasible solutions to avoid and mitigate that harm have been fully implemented.

G. In assessing any potential harm or enhancement to the significance of a heritage asset(s) the following will be considered:

1. **Avoiding successive small scale changes that lead to a cumulative loss or harm to the significance of the asset or historic environment;**
2. **Respecting the character, appearance, special interest and setting of the asset and historic environment;**
3. **Retaining architectural or historic features which are important to the character and appearance of the asset (including internal features) in an unaltered state; and**
4. **Retaining the historic form and structural integrity of the asset.**

H. Where 'enabling development' is proposed, the Council will expect the proposal to accord with Historic England's published guidance. The applicant will provide accurate evidence to establish that a 'heritage deficit' exists. It is not the role of 'enabling development' to reimburse owners or applicants who have paid above the market value of asset, that value being based on the current condition of the asset.

I. Proposals will be accompanied by an appropriate desk-based assessment and field evaluation where development is proposed affecting an unscheduled site of known archaeological interest or with the potential to include heritage assets with archaeological interest (General requirement for applications affecting heritage assets).

J. The ability to record evidence of our past should not be a factor in deciding whether the loss of significance should be permitted. Where harm to or loss of heritage assets occurs as a consequence of development it will be necessary for developers to record and advance understanding of the significance of the affected assets in a manner proportionate to their importance and the impact (NPPF paragraph 141).

Recording techniques should keep in step with current best practice and in particular the use of photogrammetry and fine grain LIDAR ground scans where unavoidable loss will occur. In the case of heritage assets of greater than local importance the results of this recording work should be published in the relevant local or period journal or in book form according to the scale and significance of the assets affected. Where significant archaeological remains are found, provision shall be made for public open days, exhibitions and/or popular publications/booklets. Where archaeological remains are preserved within public open space appropriate on-site interpretation and a strategy for long term care (and funding thereof) shall be produced as part of a holistic approach to the long term stewardship of the open space in question and agreed with the body responsible for the same. Where recording or assessment results in a physical archive for deposition at an appropriate museum or archive facilities, consideration of resources for its storage, interpretation and public access should be made in order to capture the heritage significance of that asset for future generations.

Policy DS6
LINEAR PARKS

A. The following areas are defined as Linear Parks on the Policies Map:

1. **The Ouse Valley, from the Borough boundary at Passenham to the M1 motorway.**
2. **The Ouzel/Lovat Valley, from Water Eaton to the River Ouse, including the valleys of the Broughton and Caldecotte Brooks within the city.**
3. **The Loughton Brook Valley and Tattenhoe Valley.**
4. **Emberton Country Park.**

B. B. Development proposals in the Linear Parks should contribute to achieving the following objectives:

1. **Protecting and improving the landscape.**
2. **Protecting and enhancing features of nature conservation value.**
3. **Retaining and improving public access to land and water areas for countryside recreation.**
4. **Flood control.**
5. **Minimising any adverse impact on local residents and agriculture.**
6. **Protecting and interpreting areas of archaeological interest.**

2.16 The site forms part of a Strategic Site Allocation in Plan:MK, to comprise residential and employment development as follows:

Policy SD9
GENERAL PRINCIPLES FOR STRATEGIC URBAN EXTENSIONS

A. Proposals for Strategic Urban Extensions, and the documents required under SD10 to guide their development, should be prepared in accordance with the principles set out below. This policy will also be applied to any planning application(s) for unallocated strategic development sites.

…3. To be supported by or incorporate: …

ii. An archaeological investigation (with reference to the Historic Environment Record and further assessment if required) and consideration of the Historic Landscape Characterisation to inform the layout of development…

Policy SD12
MILTON KEYNES EAST STRATEGIC URBAN EXTENSION

A. Land is allocated at Milton Keynes East – as shown on the Key Diagram and Policies Map – for a comprehensive new residential and employment development to meet the long-term needs of Milton Keynes. Development can commence once the necessary strategic infrastructure required to make the site deliverable is funded and is being delivered. In that circumstance, the development of the site will be allowed to proceed within the plan period as an additional source of housing and employment land supply.

B. Development will be brought forward in line with all relevant policies in Plan:MK, particularly Policies SD1, SD9, SD10 and INF1. A comprehensive development framework for the site will be prepared in accordance with the Policies SD1, SD9, SD10 and INF1 and approved by the Council prior to planning permissions being granted.

C. The development framework and subsequent applications for planning permission will establish the quantum and form of development in more detail, but proposals for development will be expected to meeting the following criteria:

1. Delivery of around 5,000 new homes, including at least 1,475 homes within the plan period, providing a range of sizes, types and tenures, including affordable housing, in accordance with other policies in the Plan.

2. Around 105 hectares of land for a mix of employment uses, complementing the role and function of CMK.

3. **Associated infrastructure including primary and secondary education, community facilities, health, retail and local services and a hotel. The development should comprise at least one district centre and/or local centre(s), of scale commensurate to the needs of the new community and that would not adversely affect the viability and vitality of Newport Pagnell district centre, with a co-location of key facilities.**

4. **The phased introduction of a comprehensive network of transport infrastructure in line with the Local Investment Plan, to include grid road connections to H4/V11 to the west and improved highway connections to Newport Pagnell and Central Milton Keynes (CMK), including new and/or enhanced vehicular crossings of the M1, involving highway works on and off-site.**

5. **A corridor of land safeguarded for a fast mass-transit system, and associated infrastructure, enabling connectivity to CMK and other key destinations. The width of the corridor should be sufficient to enable a range of possible transit solutions to come forward whilst also ensuring the efficient use of land for achieving the scale of development proposed within this policy.**

6. **A network of segregated, and where appropriate grade-separated, new and enhanced footpaths, cycleways and bridleways (including redways) to connect to existing routes beyond the site, including provision of appropriate pedestrian and cyclist crossings of the A422 and suitable safe and attractive crossings of the M1 as appropriate.**

7. **A strategic green infrastructure framework and network of green spaces to meet strategic and local requirements that follows the guidance in the Council's Landscape Character Assessment and Green Infrastructure Strategy to ensure ecological connectivity, protect the identity and character of nearby settlements and mitigate any significant impacts on the landscape in accordance with Policy NE5.**

8. **The creation of a linear park through the site that broadly correlates with the River Ouzel floodplain and existing green infrastructure assets of value within and adjacent to it.**

9. **Be informed by appropriate surveys of archaeology, built heritage and ecology with appropriate mitigation of impact as consistent with other policies of the Plan and the NPPF. An archaeological field study, including a Geophysical Survey, where appropriate following desk-based assessment, will required to identify potential below ground archaeology. Where feasible, the Council will expect below ground archaeology to be kept in situ in preference to its removal.**

2.17 The Milton Keynes East Development Framework was adopted by the Cabinet of Milton Keynes Council on 10 March 2020 following a call-in of the decision to adopt the Supplementary Planning Document (SPD) on 13 January 2020.The SPD provides guidance on how the allocation of Milton Keynes East (Policy SD12 and other relevant policies) within Plan:MK should be planned and developed. The SPD is an important material consideration when determining relevant planning applications.

2.18 The SPD makes the following conclusions with regard to archaeology and the allocated site:

"Masterplanning of the site should protect the integrity and character of Moulsoe village, and be respectful of the character of other adjoining areas, such as parts of Newport Pagnell close to the site. Given the level of enclosure separating it from adjacent areas, and given the scale of MKE, the development has an opportunity to create a unique character of its own.

It will be necessary to identify archaeological constraints (particularly buried archaeological remains) by field evaluation at the earliest opportunity and prior to the submission of a planning application. Developers are recommended to contact the Council's Archaeology Officer at as early a stage as possible to discuss individual circumstances."

2.19 In terms of relevant designated archaeological assets, as defined above and as shown on Figure 2a, no designated World Heritage Sites, Scheduled Monuments, Historic Battlefield sites or Historic Wreck sites lie within the vicinity of the study site.

2.20 This assessment addresses below ground archaeological assets only and does not address any built heritage issues.

2.21 In line with relevant planning policy and guidance, this desk based assessment seeks to clarify the site's archaeological potential and the need or otherwise for additional mitigation measures.

3.0 GEOLOGY AND TOPOGRAPHY

Geology

3.1 The British Geological Survey (BGS Online 2021) indicates that the solid geology of the site generally comprises Mudstone formations, with a mix of Sandstone, Siltstone and Mudstone on the far west of the study site.

3.2 Alluvial deposits are located within the immediate vicinity of the River Ouzel in the western half of the site, whilst gravel terraces and head deposits associated with the river valley are recorded either side of the river. Previous site investigation boreholes recorded by the British Geological Survey are concentrated across the western half of the study site, and generally confirm the underlying geology of the alluvial floodplain.

3.3 Further deposits of Oadby Member (Diamicton) and small pockets of glaciofluvial deposits are recorded across much of the eastern half of the study site.

Topography

3.4 The River Ouzel meanders north-south through the site, creating a river valley within the western half of the site.

3.5 The river and its floodplain lie at approximately 57m Above Ordnance Datum (AOD). Land to the west of the floodplain rises gently to c.65m AOD at the far western corner, whilst the topography of the eastern half of the site generally comprises land sloping down towards the river valley, and away from an area of high ground at Moulsoe immediately to the east, and a further area of high ground at the north east corner of the study site. These areas of high ground are generally situated at a height of c.80-90m AOD.

4.0 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND, WITH ASSESSMENT OF SIGNIFICANCE

4.1 Timescales used in this report:

Prehistoric

Palaeolithic	900,000	-	12,000	BC
Mesolithic	12,000	-	4,000	BC
Neolithic	4,000	-	1,800	BC
Bronze Age	1,800	-	600	BC
Iron Age	600	-	AD 43	

Historic

Roman	AD	43	-		410
Saxon/Early Medieval	AD	410	-		1066
Medieval	AD	1066	-		1485
Post Medieval	AD	1486	-		1799
Modern	AD	1800	-		Present

4.2 Introduction

4.2.1 This chapter reviews the available archaeological evidence for the study site and the archaeological/historical background of the study site and surrounding area, and, in accordance with NPPF, considers the potential for any as yet to be discovered archaeological evidence on the study site prior to any assessment of any later development or below ground impacts.

4.2.2 What follows comprises a review of known archaeological assets within a 500m buffer from the study site boundary (Figs. 2a-b), also referred to as the study area, held on the Milton Keynes Historic Environment Record (HER), together with a historic map regression exercise charting the development of the study area from the 18th century onwards until the present day. The results of geophysical survey across a majority of the study site have also been incorporated into this assessment.

4.2.3 In terms of relevant designated archaeological assets, as defined above in Section 2 and as shown on Figure 2a, no designated World Heritage Sites, Scheduled Monuments, Historic Battlefield sites or Historic Wreck sites lie within the vicinity of the study site.

4.2.4 In general, the HER records within the study area comprise evidence for a diverse archaeological landscape, comprising artefactual evidence for the prehistoric periods, and occupation activity from the later prehistoric periods through to the present day.

4.2.5 Previous archaeological work undertaken within the study site comprises programmes of fieldwalking, geophysical survey, evaluation trial trenching and some areas of excavation as part of schemes to widen the M1 motorway in the 1990s. These works have identified Neolithic/Bronze Age artefactual evidence, two prehistoric occupation sites, possible ring ditches, a likely Iron Age/Roman settlement, a likely Roman to Medieval settlement, and Medieval ridge and furrow activity.

4.2.6 The map regression exercise has demonstrated that the study site has generally comprised open agricultural or pastoral land from the Post Medieval period until the present day, with only minor instances of agricultural development and brickearth extraction activity.

4.2.7 Chapter 5 subsequently considers the site conditions, later development and below ground impacts, and whether the proposed development will impact the theoretical archaeological potential identified below.

4.3 **Geophysical Survey**

4.3.1 Two phases of geophysical survey have been undertaken across the study site in March 2020 (Appendix 1, Sumo 2020) and in May 2020 (Appendix 2, Magnitude 2020). The Phase 1 work in March 2020 covered generally northern and western areas of the study site, whilst the Phase 2 work in May 2020 covered much of the south eastern area of the site.

4.3.2 The Phase 1 work identified several archaeological sites, some of which were previously known from cropmark or other data, whilst others represent previously unknown areas of likely archaeological remains. These included two prehistoric occupation sites, an extensive Romano-British to Medieval settlement and a large undated enclosure adjacent to the River Ouzel.

4.3.3 The work undertaken in May 2020, as Phase 2 of geophysical survey, identified two foci of archaeological activity, comprising two settlement sites. It was suggested that one of these comprised of settlement Iron Age to Roman in form, included a series of likely round houses and other structures arranged along the course of a ridgeline. The second

area of settlement comprised a multi-phase large rectilinear enclosure, which was thought to be a continuation of settlement identified in the Phase 1 survey, postulated as a Romano-British to Medieval dated settlement.

4.4 Palaeolithic

4.4.1 Evidence for Palaeolithic human activity within the study area comprises a finished axehead and a single flint flake found at Newport Pagnell to the north west of the study site (HER Refs: MMK3636-7, SP 88800 43200 & NMR Ref: 344978). A complete ox horn and a fragment of a further horn were found at the base of a gravel pit within the area of the Cotton Valley Sewage Works at the south west extent of the study area (HER Ref: MMK1598, SP 88400 40900).

4.4.2 The presence of Palaeolithic material can be notoriously difficult to predict and is typically dependent upon the presence of an appropriate underlying geology sequence (such as terrace gravels or brickearth), as well as suitable topography and access to nearby resources and water. Whilst the alluvial deposits likely present within the western area of the study site are considered too late in date to contain Palaeolithic material, the potential presence of residual flintwork artefacts cannot be discounted at depth within any underlying river terrace gravel deposits which may be present. Therefore, a generally low to moderate archaeological potential is identified for the Palaeolithic period within close proximity to the River Ouzel, and a generally low potential is identified for the remainder of the study site (see Figure 16a).

4.5 Mesolithic

4.5.1 A largely residual Mesolithic flint scatter was recorded during excavation at a site c.250m south of the study site boundary (HER Ref: EMK990, SP 89400 40500).

4.5.2 On the basis of the paucity of evidence within the study area, the archaeological potential of the study site for the Mesolithic period is considered to be low.

4.6 Later Prehistoric – Neolithic & Bronze Age

4.6.1 The Milton Keynes HER records only limited evidence for Neolithic occupation activity within the study area, in the form of an early Neolithic pit which included a plain bowl pottery assemblage, identified c.250m south of the study site during archaeological excavation (HER Ref: EKM990, SP 89400 40500).

4.6.2 Further evidence for Neolithic activity comprises Neolithic/Bronze Age flintwork which is recorded throughout much of the study area and has generally been identified during systematic fieldwalking programmes both within the study site and the immediate area. Generally, any finds are recorded along the southern area of the study site (HER Refs: MMK503, MMK3965, MMK3977-8, MMK3980-2). Further findspots of Neolithic and Bronze Age flintwork are concentrated to the north west and south west of the study site (HER Refs: MMK475, MMK982-9, MMK1235, MMK3851).

4.6.3 Cropmark evidence for possible Bronze Age ring ditches and barrow cemeteries are recorded within the western part of the study site (HER Refs: MMK502, MMK504, MMK929-30 & NMR Ref: 345028), and recent geophysical survey been able to confirm likely ring ditches at these locations (SUMO 2020 and see Appendix 1, Section 5.1.1). Further possible ring ditches have been identified from cropmarks to the west of the site (HER Ref: MMK993/NMR Ref: 345034), to the south of the M1 (HER Refs: EMK898 & MMK1120/NMR Ref: 641446, & NMR Ref: 344979), and to the east of the site (NMR Ref: 16222028).

4.6.4 The HER records further Bronze Age occupation activity to the south of the study site, including cremation burials at Cotton Valley Sewage Works to the south of the M1 (HER Refs: MMK1120-2, SP 88600 40910), and at Broughton Barn Quarry to the south east of the study site (NMR Ref: 1330218/1393304/1354482, SP 9076 4056). A bronze socketed axe is recorded at a likely inaccurate location south west of the study site, as the event record notes the find at Bradwell, 5km to the west (HER Ref: EKM408, SP 88248 41321).

4.6.5 Neolithic and Bronze Age evidence is generally located to the south and western areas within the study area, whilst the majority of evidence recorded within the study site comprises artefactual evidence which is not indicative of settlement or occupation activity. Possible ring ditch cropmarks are recorded within the western part of the study site on recent geophysical survey. Therefore, whilst a generally low to moderate archaeological potential can be identified across the study site for Neolithic/Bronze Age artefactual evidence, a specific potential is identified at the western end of the study site for possible Bronze Age ring ditches (see Figure 16b).

4.6.6 A moderate potential for organic palaeoenvironmental evidence dating to the later prehistoric periods within the Ouzel River Valley can be considered, as indicated on Figure 16a.

4.7 **Iron Age & Roman**

4.7.1 Recent geophysical survey has identified an area of settlement in the centre of the study site, north of the Holiday Inn and bisected by the London Road (SUMO 2020 and see Appendix 1). The form of the settlement suggests that it may have originated during the Iron Age and it has been suggested that the settlement pattern indicates that it may have multi-period remains dating through the Iron Age, Roman, Saxon and Medieval periods. A second phase of geophysical survey (Magnitude 2020 and see Appendix 2) identified further enclosures which were considered part of this settlement area.

4.7.2 A further area of likely prehistoric settlement, comprising possible round houses and enclosures, is shown in the geophysical survey data in the northern part of the site (SUMO 2020 and see Appendix 1, Areas 8 and 11). A collection of likely round hosues and associated structures and enclosures is shown in the geophysical survey data along a ridgeline in the south eastern part of the site (Magnitude 2020 and see Appendix 2, Area 11).

4.7.3 A middle Iron Age occupation site is recorded at Tickfordfield Farm to the north of the study site, which comprised an occupation layer containing pottery fragments, bone and charcoal (HER Ref: MMK3411, SP 89480 43450 & NMR Ref: 657222). In addition, possible traces of an Iron Age building were recorded to the south east of this, near to the study site's north east corner (HER Refs: MMK546-7, SP 90000 43100).

4.7.4 Geophysical survey along the route of the M1 widening scheme in the 1990s identified enclosure ditches and pits, possibly representing late Iron Age or Roman agricultural activity (HER Ref: MMK7915, SP 89085 41700). This record is given an inexact grid reference in the centre of the study site as the detailed location is unknown. The National Monuments Record also notes that archaeological evaluation work was undertaken along the route of the M1 motorway which identified evidence for Iron Age and Roman ditches, pits and possible occupation (NMR Ref: 1324853, SP 8815 4165 to SP 8030 4924). It seems that occupation may have been located around a site at West Caldecote to the west of the study site where a substantial number of Iron Age and Roman features have been identified (HER Ref: MMK934, SP 87448 42218). A further settlement site is recorded at Brooklands, c.400m south of the study site, which suggested a fairly

confined settlement surrounded by associated field systems (HER Ref: EMK989-90, SP 89800 40100).

4.7.5 The HER notes Iron Age/Roman features generally comprising enclosures, ditches and pits at Broughton c.500m south of the study site (HER Refs: MMK1593-6 & EMK967, SP 89310 40270 & NMR Ref: 1343554), at the Cotton Valley Sewage Works site to the south of the M1 (HER Refs: MMK1244-7, SP 88500 40800 & NMR Ref: 344979), within the area south of M1 junction 14 (HER Ref: EMK982, SP 89283 40458), and also at Broughton Farm to the south east of the study site (NMR Ref: 1324848 & 1330218, SP 9076 4056). In addition, evidence for an Iron Age/Roman field system is recorded at London Road to the north of the study site (HER Refs: MMK7918, SP 88798 43046 & NMR Ref: 1454307). It is likely that these comprise evidence for activity associated with the settlements at Brooklands and at West Caldecote.

4.7.6 The nearest major Roman routeway to the study site as recorded by Margary (1955) is Watling Street, which passes through Milton Keynes c.6km south west of the study site. However, the smaller road known as 'Viatores 175' is projected to pass through the western end of the study site, possibly fording the River Ouzel adjacent to the study site's north west corner (NMR Ref: 868140 & HER Ref: MMK457, SP 88400 42600). A number of finds comprising pottery fragments and a quern stone have been made within the immediate area of this likely fording spot, which may indicate the presence of an occupation site near to the ford, or activity associated with the settlement at West Caldecote to the west (HER Refs: MMK545-6, SP 88400 42600 & NMR Ref: 344993). No evidence for the road was identified during recent geophysical survey (SUMO 2020 and see Appendix 1). Typical archaeological features associated with Roman roads can include evidence for settlement and occupation, roadside ditches and associated land division, together with quarry pits, burials and chance losses.

4.7.7 Further evidence for the Iron Age and Roman periods within the study area comprises artefactual evidence which is not discussed in detailed here, as it is generally located within areas of occupation activity or adjacent to routeways which are noted above. Fieldwalking within the study site has identified a single sherd of Roman pottery, which is recorded in the centre of the study site (HER Ref: MMK3979, SP 89300 40950 & MMK3980, SP 89400 41250), whilst further pottery sherds and a metal artefact have been found to the east at Moulsoe (HER Refs: MMK552-4, SP 90670 41760 & MMK7174, SP 90315 41953).

4.7.8 The study site would have comprised a settled agricultural landscape during the Iron Age and Roman periods, characterised by scattered farmstead settlements surrounded by an agricultural hinterland. Recent geophysical survey has identified foci of likely Iron Age/Roman occupation activity across the study site. Therefore, a high archaeological potential can be identified within areas of likely occupation identified by geophysical survey and also associated with the posited Roman road alignment (see Figure 16c). A generally low to moderate potential is suggested across the remainder of the study site for evidence associated with agricultural activity.

4.7.9 It is possible that further alluvial deposits may date to the Iron Age or Roman periods within the River Ouzel Valley, and therefore a moderate potential is suggested for organic palaeoenvironmental evidence dating to these periods within the Ouzel River Valley, as indicated on Figure 16a.

4.8 **Anglo-Saxon/Early Medieval & Medieval**

4.8.1 Recent geophysical survey has identified an area of settlement in the centre of the study site, north of the Holiday Inn and bisected by the London Road (SUMO 2020 and see Appendix 1). The form of the settlement suggests that it may have originated during the Iron Age and it has been suggested that the settlement pattern indicates that it may have multi-period remains dating through the Iron Age, Roman, Saxon and Medieval periods. A further phase of geophysical survey (Magnitude 2020 and see Appendix 2) identified further enclosures which were considered part of this settlement area.

4.8.2 A middle 5th century sunken featured building was identified during works at Brooklands, to the south of the M1, which may be indicative of a Saxon settlement within that area (HER Ref: EMK990, SP 89400 40500). Two early Saxon pits were also recorded to the south of this at Broughton (HER Ref: EKM967, SP 89330 40250).

4.8.3 A programme of fieldwalking during the widening of the M1 identified a single sherd of Saxon pottery, at a findspot which is recorded at the southern boundary of the study site (HER Ref: MMK3979, SP 89300 40950). A further programme of fieldwalking to the north west of Caldecote in the north western extent of the study area identified circa 70 sherds of Saxon pottery (HER Ref: MMK991, SP 88310 42740).

4.8.4 Gravel extraction in 1900 at the northern extent of the study area revealed a Saxon cemetery, and a number of associated grave goods (HER Refs: MMK474/476& MMK7720-2, SP 88770 43310 & NMR Ref: 344952)

4.8.5 Several late Saxon estates are recorded within the area of the study site by the Domesday Survey of 1086 (Domesday Online 2021). These include:

- Tickford – located to the north of the study site, medium sized estate of 15 households, assessed for a fairly large total tax of 5 geld units;
- Moulsoe – located to the east of the study site, medium sized estate of 17 households, assessed for a very large total tax of 10 geld units. The HER notes the location of the manor house and the historic core of settlement at Moulsoe to the east of the study site (HER Refs: MMK159, SP 90748 41742; MMK548-51, SP 90600 41600; MMK3629, SP 90656 41746; MMK5412, SP 90582 41637 & NMR Ref: 1576671);
- Broughton – located to the south of the study site, medium sized estate of 17 households, assessed for a fairly large total tax of 5 geld units. The HER notes the associated shrunken Medieval village of Broughton (HER Ref: MMK3482, SP 89675 40062 & NMR Ref: 344989).
- Milton (Keynes) – located to the south of the study site, very large estate of 37 households, assessed for a very large total tax of 10 geld units;
- Newport (Pagnell) – located to the north of the study site, medium sized estate of 14 households, assessed for a fairly large total tax of 5 geld units;
- Caldecote – located to the north west of the study site, listed by the HER as comprising a moated manorial site, with possible associated deserted village or manorial buildings, and a mill (HER Refs: MMK87, SP 88170 42290; MMK90, SP 88332 42322; MMK91, SP 88029 42288; MMK92, SP 88335 42340; MMK93, SP 88010 42380; MMK1078, SP 88430 42650; MMK3423, SP 88220 42075 & NMR Refs: 344953 & 1592528).

4.8.6 The nearest of these estates to the study site are Caldecote to the north west and Moulsoe to the east. The lands associated with the estate at Moulsoe comprise plough land, meadows and woodland (Domesday Online 2021). It is therefore likely that the study site was located within an area of mixed arable land, pasture, and woodland at

the time of the Domesday Survey. The HER also notes a mill that was recorded within Moulsoe Hundred by the Domesday Survey, although it is acknowledged that the mill may not be located within Moulsoe Parish (HER Ref: MMK3763, SP 91000 41500).

4.8.7 In addition to the above Saxon estates, the HER also records the estate and village at Willen to the south west of the study site, which was first documented in AD1189 (HER Ref: MMK5481, SP 87903 41209).

4.8.8 Evidence for Medieval ridge and furrow agricultural activity is noted by the HER in the far western extent of the study area (HER Ref: MMK7915, SP 89085 41700 & NMR Ref: 915523), which is also evident on the LiDAR plot (see Figure 3 and Section 4.11 below) and in recent geophysical survey (SUMO 2020 and Magnitude 2020).

4.8.9 It is likely that the study area remained characterised by scattered estate centres and farmsteads, interspersed with agricultural and pastoral land, during the Saxon and Medieval periods. Suggested areas of occupation have been identified in the centre of the study site, bisected by the London Road, and also in the south eastern area, which in each case may comprise continuous settlement from the late Prehistoric through to the Medieval period. Therefore, whilst a generally low archaeological potential can be identified for evidence of Saxon or Medieval settlement across much of the study site, a high potential is identified within areas of likely occupation as shown on Figure 16d. A generally moderate archaeological potential is identified across the site for evidence of associated agricultural activity and land division.

4.9 **Post Medieval & Modern (including map regression exercise)**

4.9.1 A number of the HER records within the study area refer to Post Medieval and Modern archaeological remains which are not discussed in detail here unless relevant to the study site.

4.9.2 During the Post Medieval and Modern periods, our understanding of settlement, land-use and the utilisation of the landscape is enhanced by cartographic and documentary sources, which can give additional detail to data contained within the HER.

4.9.3 Jeffrey's 1768 Map of Buckinghamshire (Fig. 4) characterises the study site within areas of probably open land, between the various settlements and hamlets at *Newport Pagnel*

to the north west, *Mulshoe* to the east, *Broughton* to the south, *Willen* to the south west and *Caldecot* to the west. The north-south London Road bisects the study site, whilst the River Ouzel bisects the area of the study site to the west of the London Road. The London Road is recorded as the Woburn to Newport Pagnell turnpike road, which was set up in 1728 (HER Ref: MMK5881, SP 90754 39016). A number of trackways are shown branching off from the London Road towards Moulsoe and Tickford Park to the east.

4.9.4 Early 19th century enclosure maps for Moulsoe and Tickford, as well as a Willen parish map (Fig. 5) show the study site divided into agricultural and pastoral plots of land. The Tickford map notes a 'Mill Field' in the northern area of the study site, which may indicate a possible windmill within this area (HER Ref: MMK3385, SP 89100 42600). A possible location is suggested in recent geophysical survey although the interpretation remains unclear (SUMO 2020 and Appendix 1, section 5.1.18). The agricultural nature of the site is further shown on an 1814-15 Ordnance Survey Drawing (Fig. 6), which also shows a small cluster of buildings adjacent to the London Road in the centre of the study site, and a further building labelled as *Moulshoe Barn* adjacent to the London Road at the southern study site boundary.

4.9.5 By 1886 (Fig. 7), the study site generally remains characterised as areas of open agricultural and pastoral fields. The cluster of buildings in the centre of the study site was labelled as *Moulsoe Buildings*, whilst the former *Moulshoe Barn* at the southern site boundary was labelled as *Cottage Farm*. A further farm labelled as *Caldecotehill Farm* is shown adjacent and to the north of the study site boundary, adjacent to the London Road. Brickworks (HER Ref: MMK3400, SP 89000 42450) with associated brick kilns and extraction pit are shown adjacent to the London Road, with an area of allotments immediately south of this (see geometric patterned fields). A further area of allotment is shown at the eastern study site boundary, and an area of scrubland labelled *Drake's Gorse* is shown to the north of this.

4.9.6 Only minor changes are shown with the study site on 20th century mapping and aerial photography through to the present day (Figs. 8-15), as the aforementioned areas of development were expanded minimally, and much of the study site was opened up through the removal of field boundaries to create larger agricultural and pastoral fields. The first stretch of the M1 motorway between Watford and Rugby was opened in 1959 and is first shown adjacent to the southern boundary of the study site in the 1960s (Fig.

12). Minor additional development is shown adjacent to the Newport Road and the London Road by 2002 (Fig. 13). The urban expansion of Milton Keynes is first shown to the south west in 2002, which also depicts the A509 which forms the northern study site boundary. The area of the former *Moulsoe Buildings* is now shown as a hotel (Figs. 14-15).

4.9.7 Historic mapping has demonstrated that the study site has generally comprised open agricultural or pastoral land from the Post Medieval period into the Modern period, with only minor instances of Modern agricultural development and brickearth extraction activity. Therefore, a low archaeological potential can be identified for the Post Medieval period, and a generally low archaeological potential can be identified for the Modern period. Specific areas of high potential for the Modern period are identified, as indicated on Figure 16e, which are associated with 19th and 20th century development.

4.10 **Historic Landscape Characterisation Plot (Fig. 2b)**

4.10.1 The Milton Keynes Historic Landscape Characterisation data generally records the land parcels within the study site as areas of parliamentary enclosure (divided allotments).

4.10.2 Areas of 20th century prairie fields are shown at the northern and western areas of the study site (HBC4068,4079,4099), whilst an area of pre-18th century enclosure is shown at the western end of the study site (HBC4114). A small field of 20th century enclosure is shown in the northern area adjacent to the London Road (HBC4067), whilst 18-19th century woodland is shown to the east of this (HBC4098).

4.10.3 Moulsoe Buildings (see 4.8.5 above) are recorded within the centre of the study site adjacent to the London Road as pre-1885 settlement (HBC4071).

4.10.4 The Milton Keynes Urban Expansion Historic Environment Assessment (EH 2004) notes that the western area of the study site generally comprises a fragmentary historic landscape, which may be subject to minor or slight damage if it were to be developed (pp. 16-17). In addition, the remaining area of the site to the east of the London Road is highlighted as a well-preserved parliamentary enclosed landscape, upon which development within this area could have a moderate impact (pp. 16-17) (see Figure 16f).

4.11 LiDAR Plot (Fig. 3)

4.11.1 Evidence for Medieval ridge and furrow agricultural activity can be seen within the study site adjacent to the River Ouzel on available LiDAR data, whilst modern agricultural activity is evident throughout the study site. In addition, evidence for likely former land boundary ditches is present throughout much of the study site, indicative of the agricultural and pastoral use of the study site since the early Medieval period.

4.11.2 Whilst the LiDAR data does not show any significant archaeological anomalies within the site, this does not match the results of recent geophysical survey, which has identified various anomalies of likely archaeological origin.

4.12 Aerial Photographic Analysis (Plates 1-3)

4.12.1 Whilst no clear evidence for archaeological remains has been identified within the study site during a review of historic aerial photographs, evidence for agricultural ridge and furrow can be seen across much of the study site.

4.13 Undated Evidence

4.13.1 Geophysical survey as part of assessment for the M1 widening scheme in the 1990s found anomalies within the southern area of the study site which may comprise linear ditches, some of which may form enclosures, and associated pits. It was noted that the features could be archaeological in character although their proximity to the nearby Modern farmstead may indicate that they are modern in origin (HER Ref: MMK5394, SP 89550 41200).

4.13.2 A curvilinear enclosure is noted on the HER as a cropmark within the northern area of the study site (HER Ref: MMK978, SP 89060 42590), and may also be shown on geophysical survey (SUMO 2020 and see Appendix 1).

4.13.3 A further possible curvilinear cropmark enclosure is recorded to the south west of this (HER Ref: MMK3823, SP 8890 42260). This anomaly was subsequently recorded as a large undated curvilinear enclosure adjacent to the River Ouzel during geophysical survey (SUMO 2020 and see Appendix 1).

4.13.4 An undated linear cropmark which is visible as a cropmark on aerial photography is plotted on the HER within the south western area of the study site (HER Ref: MMK505, SP 88220 41950).

4.13.5 The National Monuments Record notes a further possible undated enclosure at the far western extent of the study site (NMR Ref: 915527, SP 8791 4195). This anomaly appears to have also been picked up during geophysical survey (SUMO 2020 and Appendix 1). The anomalies comprised a series of ditches and associated banks which form a multivallate, fortified enclosure, with the river providing the southern boundary. This feature remains undated, but could potentially be of early Medieval date, and if so although not designated, could conceivably be of regional to national significance.

4.14 Assessment of Significance (Designated Assets)

4.14.1 Existing national policy guidance for archaeology (the NPPF as referenced in section 2) enshrines the concept of the 'significance' of heritage assets. Significance as defined in the NPPF centres on the value of an archaeological or historic asset for its 'heritage interest' to this or future generations.

4.14.2 No relevant designated heritage assets as defined in the NPPF are recorded within, or within the vicinity of, the study site. Therefore, there are no relevant nationally significant archaeological remains within close proximity to the study site.

4.15 Assessment of Significance (Non-Designated Assets)

4.15.1 As identified by desk based work based on current evidence and archaeological works associated with geophysical survey and M1 widening schemes, archaeological potential by period and the likely significance of any archaeological remains which may be present within the study site is summarised in table form below and mapped where possible on Figures 16a-f. Any remains, should they occur on the study site, would in the context of the Secretary of State's non-statutory criteria for Scheduled Monuments (DCMS 2013) be of most likely local to regional significance.

Period:	**Identified Archaeological Potential and Likely Significance:**

Palaeolithic	Low to moderate potential for likely residual artefactual evidence within the Ouzel River Valley gravel terraces, Low (local) significance;
Mesolithic	Low potential (any evidence would likely comprise isolated residual artefacts), Low (local) significance;
Neolithic	Low to moderate potential for artefactual evidence, Low (Local) significance; Moderate potential for palaeoenvironmental evidence within the Ouzel river valley, likely to be of Low (local) significance;
Bronze Age	Generally low to moderate potential for artefactual evidence of low significance, specific potential identified for possible ring ditches of low significance; Moderate potential for palaeoenvironmental evidence within the Ouzel river valley, likely to be of Low to Moderate (local to regional) significance;
Iron Age & Roman	Generally low to moderate potential across the site for agricultural activity, specific potential associated with the projected Roman road and associated activity, as well as likely areas of occupation, evidence for agricultural activity likely to be of Low (local) significance whilst well-preserved settlement remains may be of regional significance; Moderate potential for palaeoenvironmental evidence within the Ouzel river valley, likely to be of Low to Moderate (local to regional) significance;
Anglo-Saxon & Medieval	Generally low potential for evidence of settlement and occupation activity, with a specific high potential identified in the areas of occupation identified by geophysical survey, and a moderate potential for agricultural activity and land division across the site, agricultural activity is likely to be of Low (local) significance whilst remains comprising well-preserved settlement remains may be of regional significance;
Post Medieval	Low potential (likely to be entirely invested in evidence of agricultural activity, land division and stray artefactual evidence), Low (local) significance;

Modern	Generally low potential as any remains will comprise low significance agricultural activity and land division, specific potential identified for areas 19th and 20th century development, likely Low (local) significance;
Historic Landscape	Generally fragmentary low significance historic landscape across the area west of the London Road, whilst the area east of the London Road comprises a well-preserved Parliamentary landscape of possibly local to regional significance.
Undated	Specific potential associated with an undated fortified enclosure adjacent to the River Ouzel in the north western part of the site, potentially of a regional to national significance depending on the results of further archaeological work to appropriately interpret the remains.

5.0 SITE CONDITIONS, THE PROPOSED DEVELOPMENT & REVIEW OF POTENTIAL DEVELOPMENT IMPACTS ON ARCHAEOLOGICAL ASSETS

5.1 Site Conditions

5.1.1 The study site currently comprises predominately open agricultural and pastoral land adjacent to the urban area of Milton Keynes to the south (Fig. 15). The M1 motorway forms the southern site boundary.

5.1.2 Modern phases of development, demolition and redevelopment associated with areas of 19th and 20th century development within the study site are likely to have had a localised negative archaeological impact.

5.1.3 Modern extraction activity associated with a 19th century brickworks adjacent to the London Road will have had a severe negative below ground impact on any archaeological remains which may have been present within the area of extraction (see Figure 16e).

5.1.4 Past agricultural/horticultural land use will have had a moderate but widespread archaeological impact as a result of past ploughing and allotment activity across the study site since at least the Medieval period.

5.2 Proposed Development

5.2.1 The study site has been allocated for residential development with associated infrastructure, access roads and landscaping, as part of the Milton Keynes Local Plan (adopted March 2019). Detailed development designs are not available at this time.

5.3 Review of Potential Development Impacts on Archaeological Assets

5.3.1 The proposed development will not impact on any designated archaeological assets. However, a number of known non-designated archaeological assets are present within the study site, and therefore this assessment has identified a specific archaeological potential across the site associated with these assets. In addition, the study site retains an archaeological potential for unknown archaeological assets. Any below ground archaeological assets which may be present would most likely be of local to regional significance, although the remains of a currently undated fortified enclosure could be of a regional to national significance.

5.3.2 In addition, this assessment has identified that the area of the study site to the east of the London Road comprises a well-preserved Parliamentary enclosed landscape.

5.3.3 Past impacts are generally limited to specific areas of modern development and extraction activity, although past agricultural/horticultural land use will have had a moderate but widespread archaeological impact across the study site since at least the Medieval period.

5.3.4 There are no nationally designated archaeological assets within the site or in close proximity. Therefore, from an archaeological perspective, it is considered that the site is viable for development, and that any adverse impacts on archaeological remains can be satisfactorily addressed through appropriate archaeological mitigation measures comprising preservation by record or preservation in situ as appropriate.

5.3.5 Consequently, the archaeological advisor to Milton Keynes Council will require further archaeological assessment at the site to evaluate the character and significance of areas of likely archaeological anomalies identified during geophysical survey.

6.0 SUMMARY AND CONCLUSIONS

6.1 Land North East of Milton Keynes has been allocated for comprehensive development in the Milton Keynes Local Plan 2019. Therefore, in accordance with relevant government planning policy and guidance, a desk based assessment has been undertaken to clarify the below ground archaeological potential of the study area.

6.2 In terms of relevant designated archaeological assets, no designated World Heritage Sites, Scheduled Monuments, Historic Battlefield sites or Historic Wreck sites lie within the vicinity of the study site.

6.3 This archaeological desk based assessment has identified that the site retains a low to moderate archaeological potential for the Palaeolithic period, and a low potential for Mesolithic evidence. A generally low to moderate potential is identified for Neolithic and Bronze Age artefactual evidence, whilst a specific potential associated with Bronze Age ring ditches is anticipated. A generally low to moderate archaeological potential is considered across the study site for isolated Iron Age and Roman agricultural activity, whilst a specific potential is identified in areas associated with occupation identified by geophysical survey and also associated with the projected alignment of a Roman road. A generally low potential is suggested for Saxon and Medieval occupation/settlement activity, with specific areas of high potential as identified by geophysical survey, and a moderate potential for agricultural activity and land division. A low potential is identified for the Post Medieval and Modern periods, with a specific potential anticipated within areas of modern development. A palaeoenvironmental potential associated with the alluvial deposits of the River Ouzel is also anticipated. Any below ground archaeological assets which may be present would most likely be of local to regional significance, although the remains of a currently undated fortified enclosure could be of a regional to national significance.

6.4 In addition, this assessment has identified that the area of the study site to the east of the London Road comprises a well-preserved Parliamentary enclosed landscape. Further work comprising an Historic Landscape/Hedgerow Assessment is suggested as part of any application for development.

6.5 Past impacts are generally limited to specific areas of modern development and extraction activity, although past agricultural/horticultural land use will have had a moderate but widespread archaeological impact across the study site since at least the Medieval period.

6.6 There are no nationally designated archaeological assets within the site or in close proximity. Therefore, from an archaeological perspective, it is considered that the site is viable for development, and that any adverse impacts on archaeological remains can be satisfactorily addressed through appropriate archaeological mitigation measures comprising preservation by record or preservation in situ as appropriate.

6.7 Consequently, the archaeological works which are likely to be required at the site by the archaeological advisor to Milton Keynes Council to support any future planning application are as follows:

- An Historic Landscape/Hedgerow Assessment;
- Geoarchaeological deposit modelling of the River Ouzel valley to assess the palaeoenvironmental potential of the alluvial sequence;
- Targeted archaeological trial trenching on areas of archaeological potential identified within the desk based assessment, the geophysical survey and the geoarchaeological deposit modelling.

SOURCES CONSULTED

1. General

British Library

Centre for Buckinghamshire Studies

Milton Keynes Historic Environment Record

The National Archive

2. Internet

British Geological Survey –

http://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html

British History Online – http://www.british-history.ac.uk/

Domesday Online – http://www.domesdaybook.co.uk/

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4. Cartographic

1768 Jeffrey's Map of Buckinghamshire

1802 Moulsoe Enclosure Map

1808 Map of Tickford Park

1808 Tickford Enclosure Map

1814-15 Ordnance Survey Drawing

1822 Map of Willen Parish

1824 Bryant's Map of Buckinghamshire

1838 Middleton (Milton Keynes) Tithe Map

1851 Willen Tithe Map

1886 Ordnance Survey (1:10560)

1899 Ordnance Survey (1:10560)

1924 Ordnance Survey (1:10560)

1938 Ordnance Survey (1:10560)

1945 Aerial Photograph

1950-51 Ordnance Survey (1:10560)

1958-60 Ordnance Survey (1:10560)

1967-70 Ordnance Survey (1:10560)

2002 Ordnance Survey (1:10000)

2003 Google Earth Image

2007 Google Earth Image

2010 Ordnance Survey (1:10000)

2014 Ordnance Survey (1:10000)

2016 Google Earth Image

2018 Google Earth Image

5. Historic England Aerial Photos

7th June 1946

11th October 1946

16th January 1947

28th May 1947

2nd July 1951

3rd September 1951

22nd April 1959

24th August 1959

18th October 1962

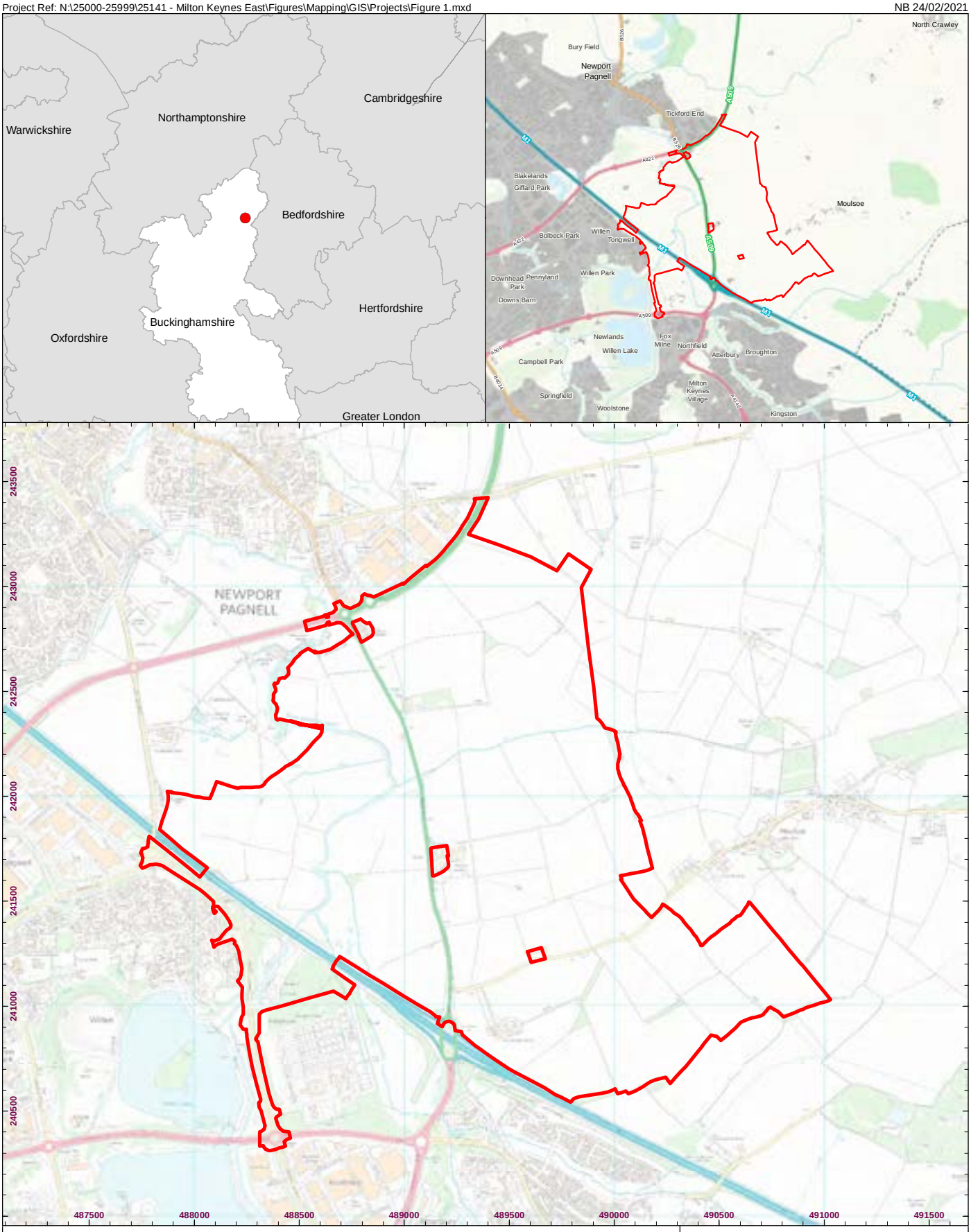
14th May 1965

30th June 1965

30th June 1968

18th August 1970

19th October 1995



Site Boundary

N

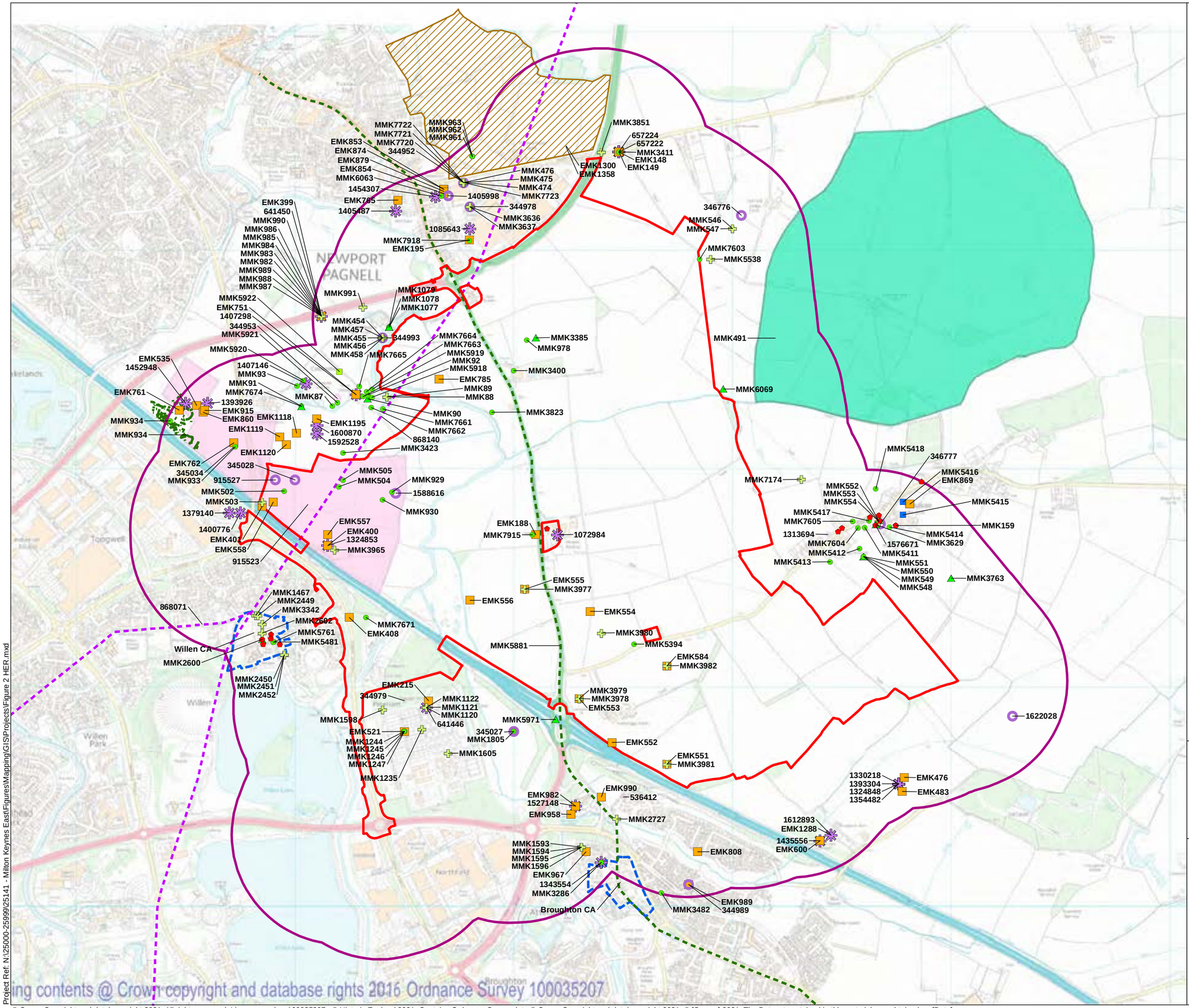
0 250 500 m

Scale at A4: 1:25,000

MAKING COMPLEX EASY

Figure 1

Site Location



Legend

- Site Boundary
- Search Radius 500m

Designated Heritage Assets:

- Listed Building
- Conservation Area

National Monuments Record:

- NMR Monument (Point)
- NMR Monument (Line)
- NMR Monument (Polygon)
- NMR Event (Point)

Non-Designated Heritage Assets:

HER Record (Point)

- Find Spot
- Monument
- Landscape
- Place
- Building

HER Record (Line)

- Monument
- Place

HER Record (Polygon)

- Place

Previous Archaeological Work:

- HER Event (Point)
- HER Event (Polygon)

N

0 250 500m

Scale at A3: 1:16,546

MAKING COMPLEX EASY

Figure 2a

HER Plot (Data from Milton Keynes HER & National Monuments Record)

Project Ref: N:\25000-25999\25141 - Milton Keynes East\Figures\Mapping\GIS\Projects\Figure 2 HER.mxd

MP 24/02/2021

HBC5158
HBC4117
HBC4099
HBC5169
HBC4097
HBC4116
HBC4098
HBC4067
HBC4095
HBC4111
HBC4065
HBC4068
HBC4064
HBC4115
HBC4114
HBC4063
HBC4049
HBC4105
HBC4079
HBC4957
HBC4052
HBC4071
HBC4047
HBC4072
HBC4088
HBC12464
HBC4113
HBC4050
HBC4048
HBC5309
HBC4087
HBC4969
HBC4077
HBC4078
HBC4140
HBC4977
HBC11687
HBC4084
HBC4968
HBC4141
HBC4085
HBC4148

Legend

- Site Boundary
- Search Radius 500m

Historic Landscape Characterisation:

- Airfields
- Allotments
- Enclosure (pre 18th Century Regular)
- Enclosure (pre 18th Century Irregular)
- Enclosure (19th Century)
- Enclosure (20th Century Prairie Fields)
- Enclosure (20th Century)
- Government and Civic Centres
- Industrial (post 1885)
- Meadow
- Motorways
- Parliamentary Enclosure (Original Allotments)
- Parliamentary Enclosure (Divided Allotments)
- Recreation (20th Century)
- Settlement (pre 1885)
- Settlement (post 1885)
- Utilities
- Woodland Secondary (18th-19th Century)

N

0 250 500m

Scale at A3: 1:16,000

MAKING COMPLEX EASY

Figure 2b

HLC Plot (Data from Milton Keynes HER)

Project Ref: N:\25000-25999\25141 - Milton Keynes East\Figures\Mapping\GIS\Projects\Figure 2b HLC.mxd

NAME 24/02/2021

Legend

- Site Boundary
- Likely former land division boundaries
- Areas of ridge & furrow activity

LiDAR DATA

Source:
Environment Agency

Data Type: DTM

Resolution: 1m

Date Captured:
Dec 2014

Processing:
simple Local Relief Model overlaid on
Multi-direction Hillshade

N

0 260 520m

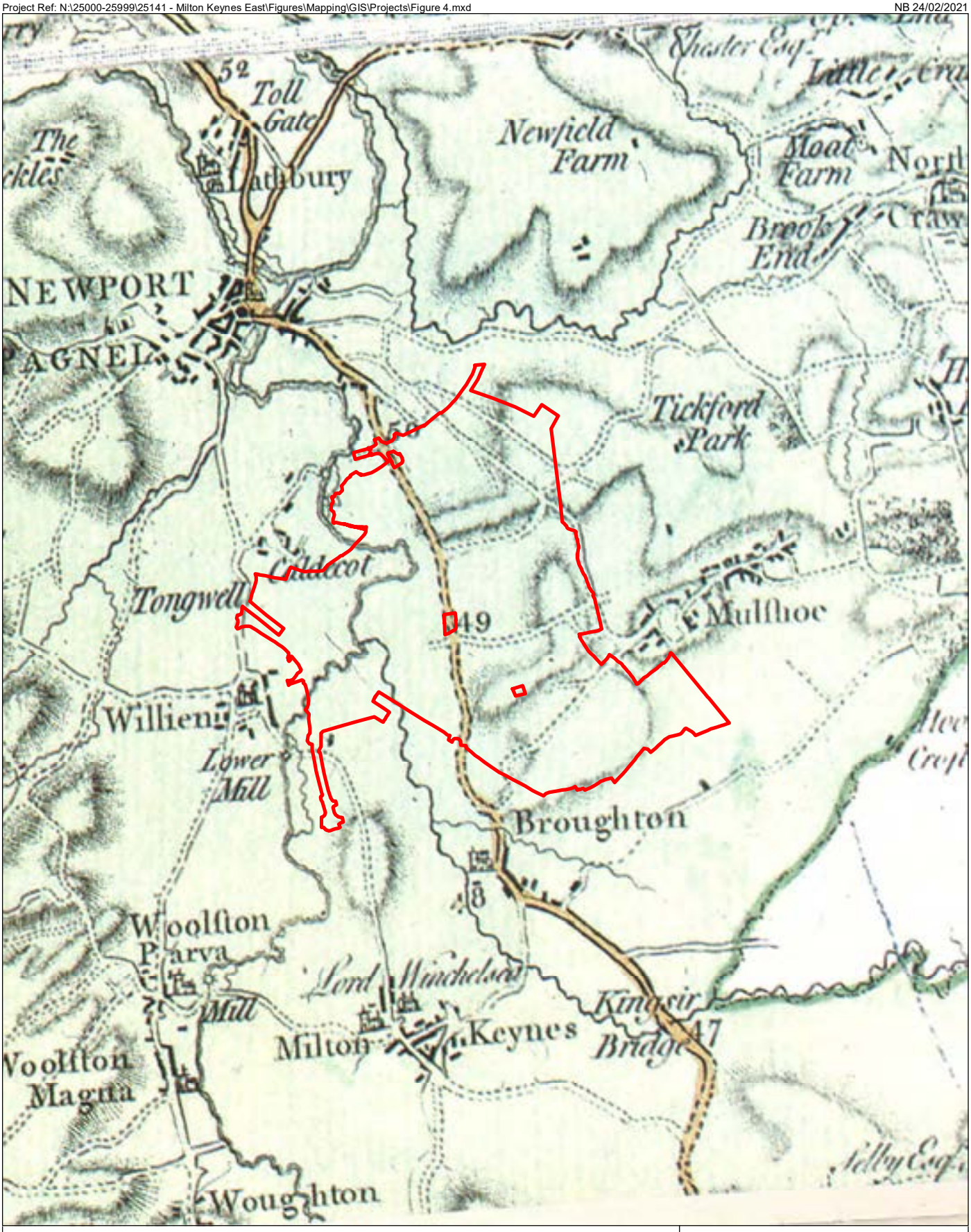
Scale at A3: 1:12,500

MAKING COMPLEX EASY

Figure 3

LiDAR Plot

Project Ref: N:\25000-25999\25141 - Milton Keynes East\Figures\Mapping\GIS\Projects\Figure 3 LiDAR.mxd



Site Boundary

N

0 250 500 750 1,000m

Scale at A4: 1:35,000

MAKING COMPLEX EASY

Figure 4

1768 Jeffrey's Map of Buckinghamshire

Site Boundary

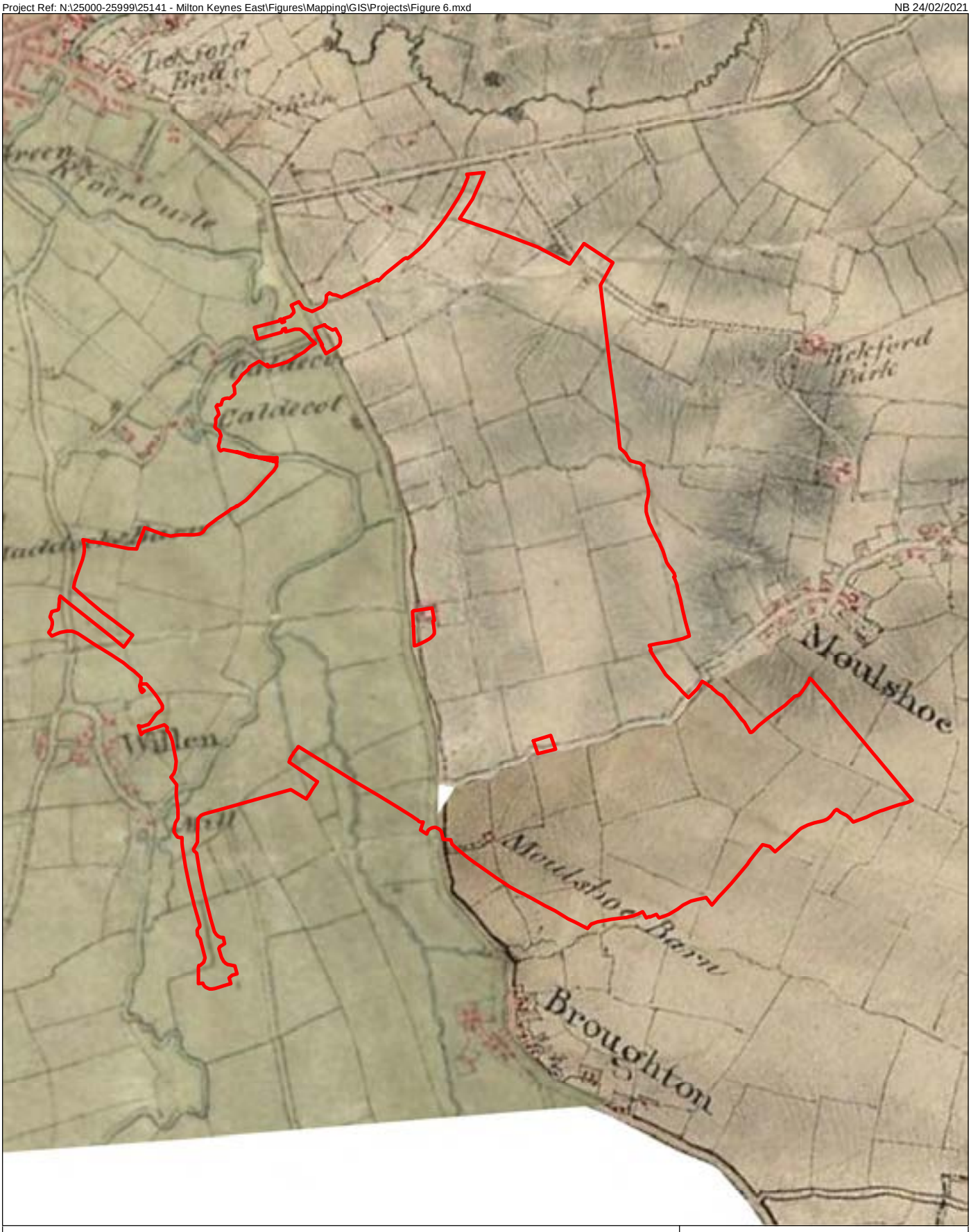
N

0 250 500m

Scale at A4: 1:20,000

MAKING COMPLEX EASY

Figure 5
1802 Moulsoe Enclosure Map, 1808 Tickford Enclosure Map (Part of Newport Pagnell Parish) & 1822 Map of the Manor and Parish of Willen



Site Boundary

N

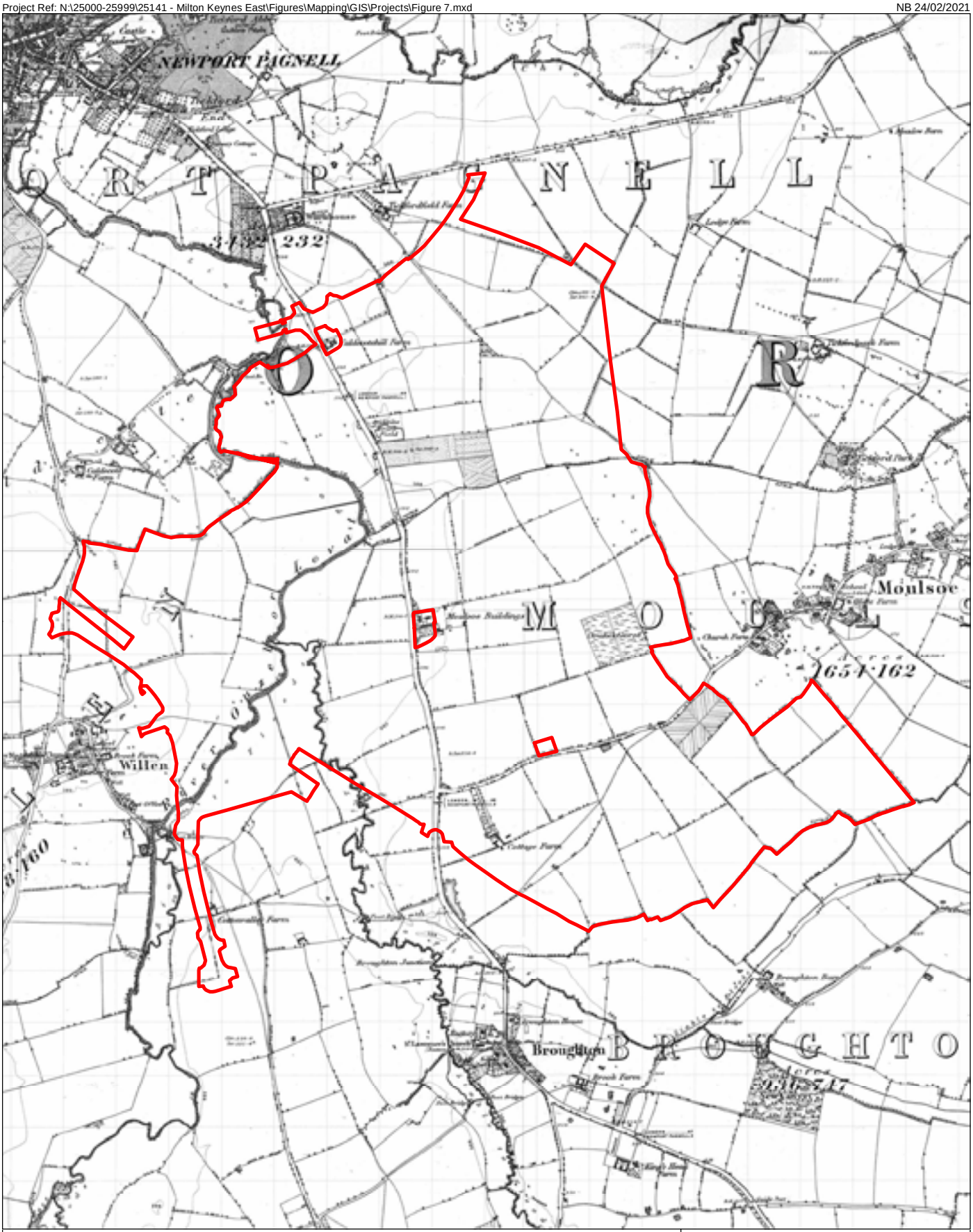
0 250 500 m

Scale at A4: 1:20,000

MAKING COMPLEX EASY

Figure 6

1814-15 Ordnance Survey Drawing



Site Boundary

N

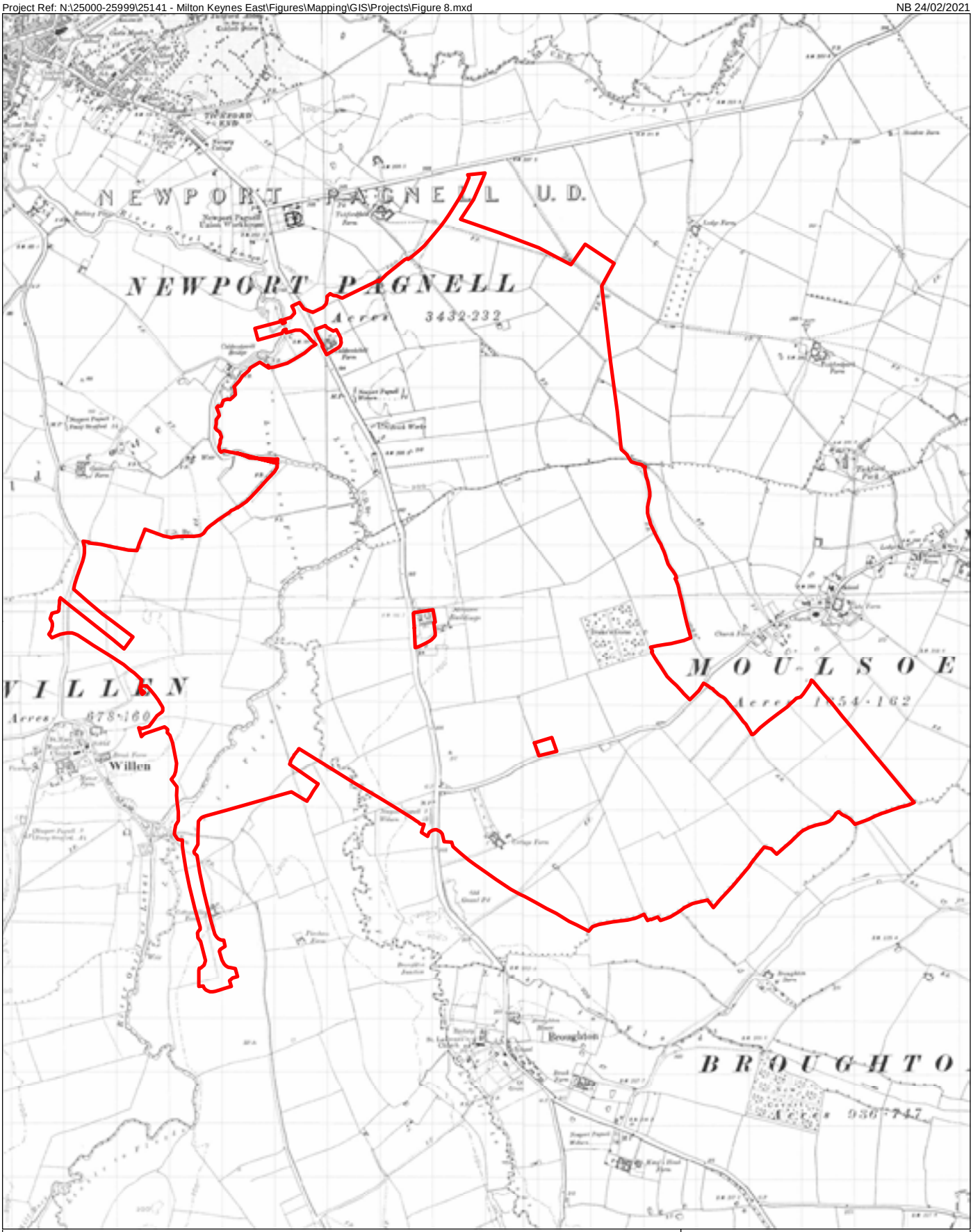
0 250 500m

Scale at A4: 1:20,000

MAKING COMPLEX EASY

Figure 7

1886 Ordnance Survey Map (1:10,560)



Site Boundary

N

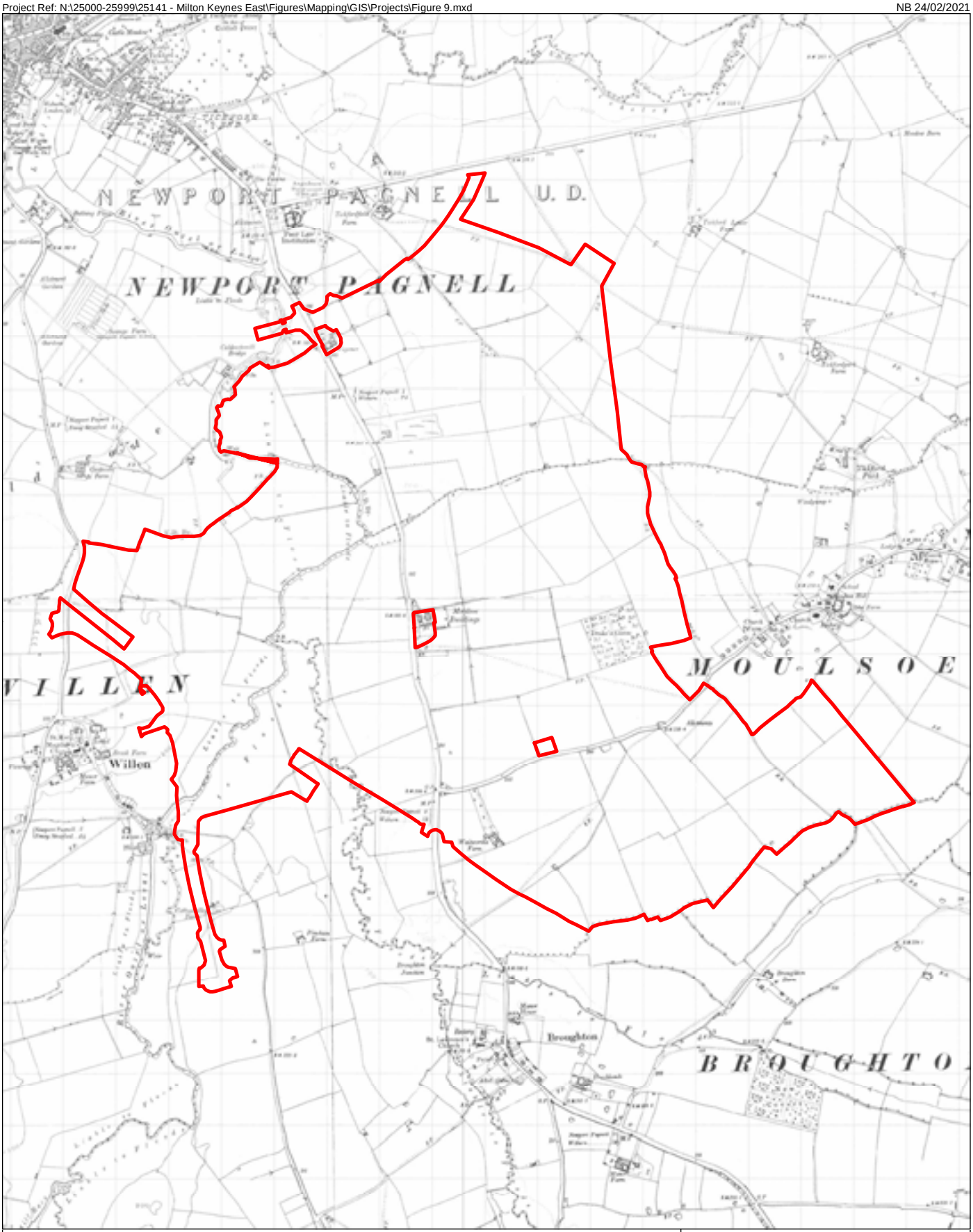
0 250 500 m

Scale at A4: 1:20,000

MAKING COMPLEX EASY

Figure 8

1899 Ordnance Survey Map (1:10,560)



Site Boundary

N

0 250 500 m

Scale at A4: 1:20,000

MAKING COMPLEX EASY

Figure 9

1924 Ordnance Survey Map (1:10,560)

Site Boundary

N

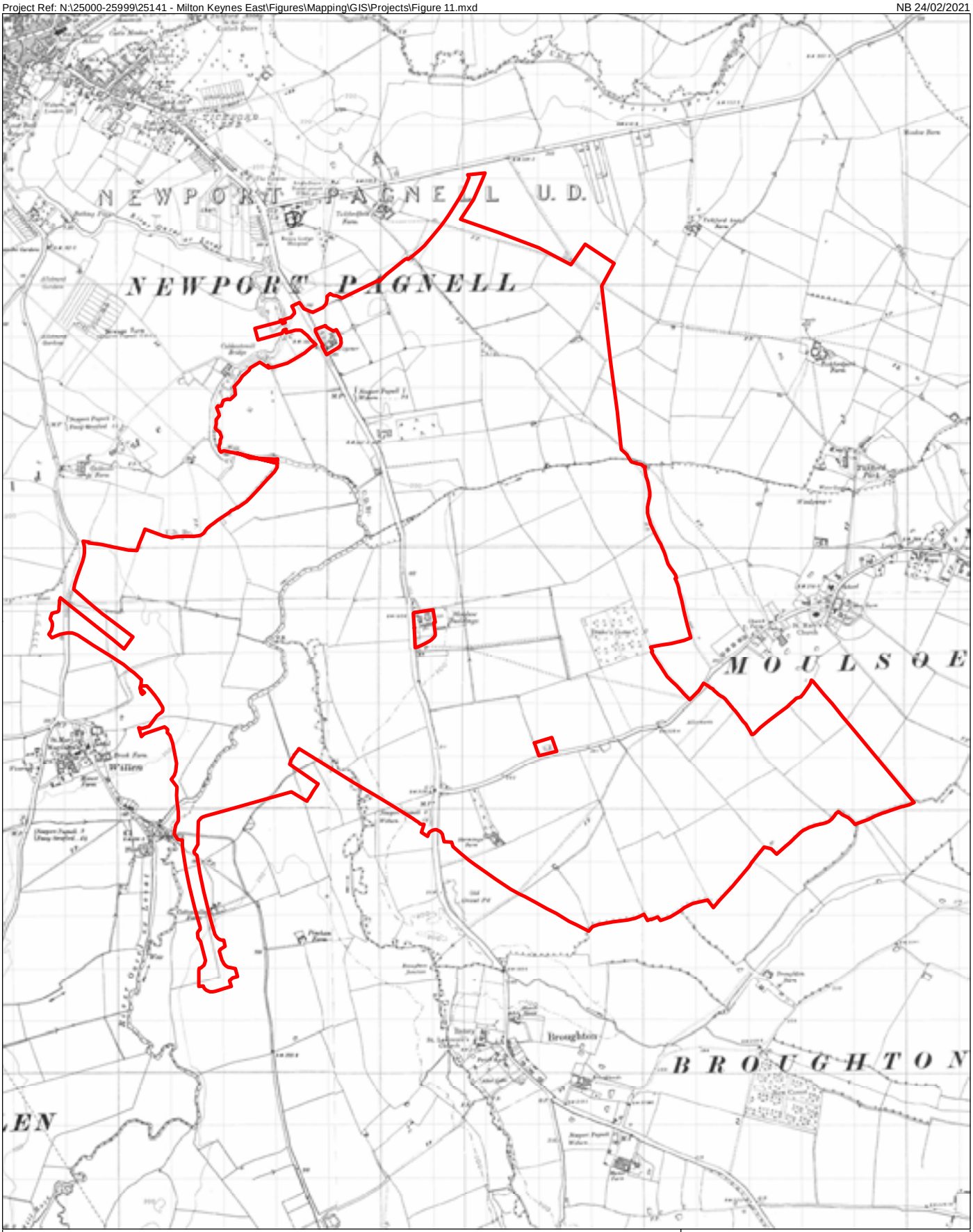
0 250 500 m

Scale at A4: 1:20,000

MAKING COMPLEX EASY

Figure 10

1945 Aerial Photograph (Google Earth Image)



Site Boundary

N

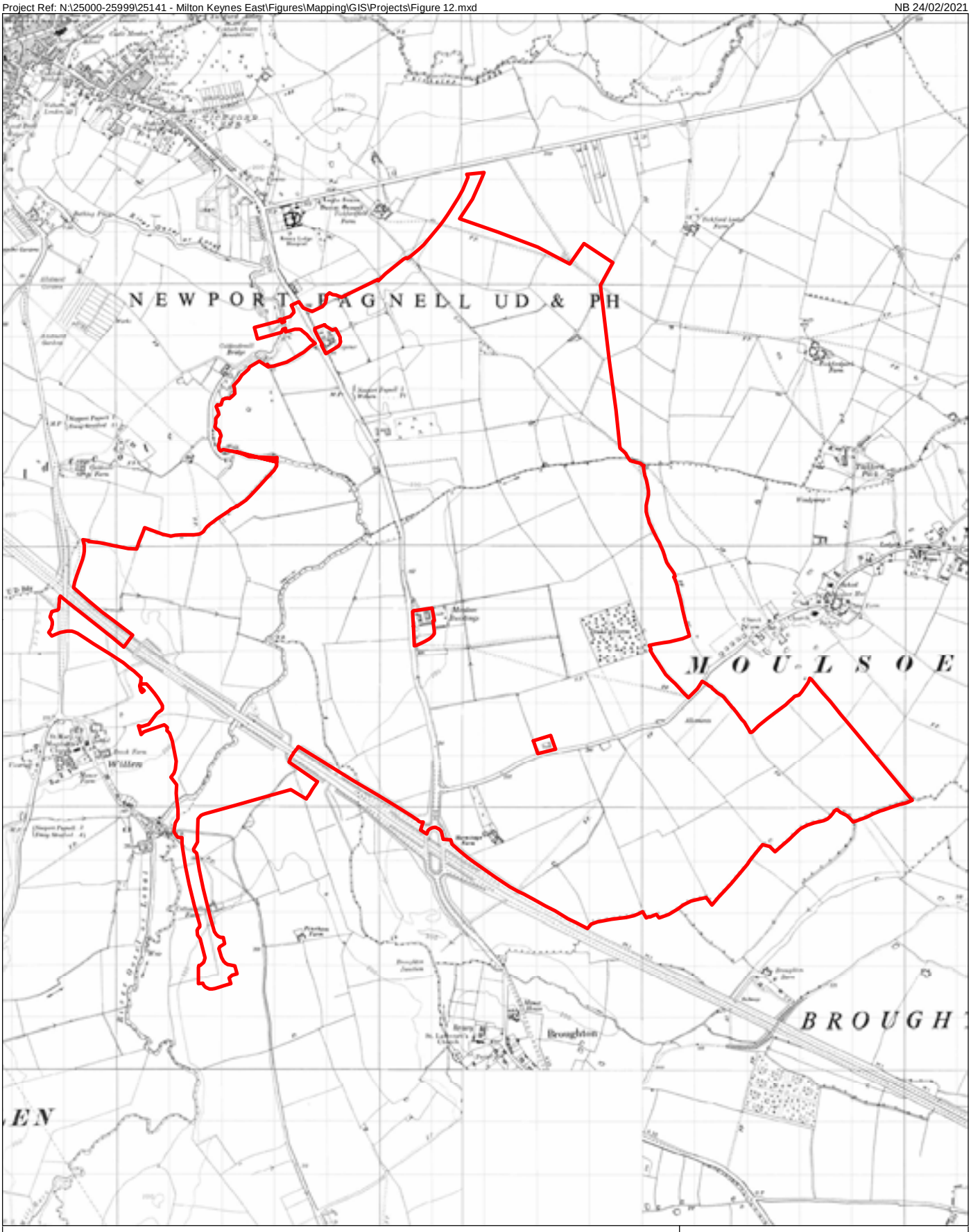
0 250 500 m

Scale at A4: 1:20,000

MAKING COMPLEX EASY

Figure 11

1950-51 Ordnance Survey Map (1:10,560)



Site Boundary

N

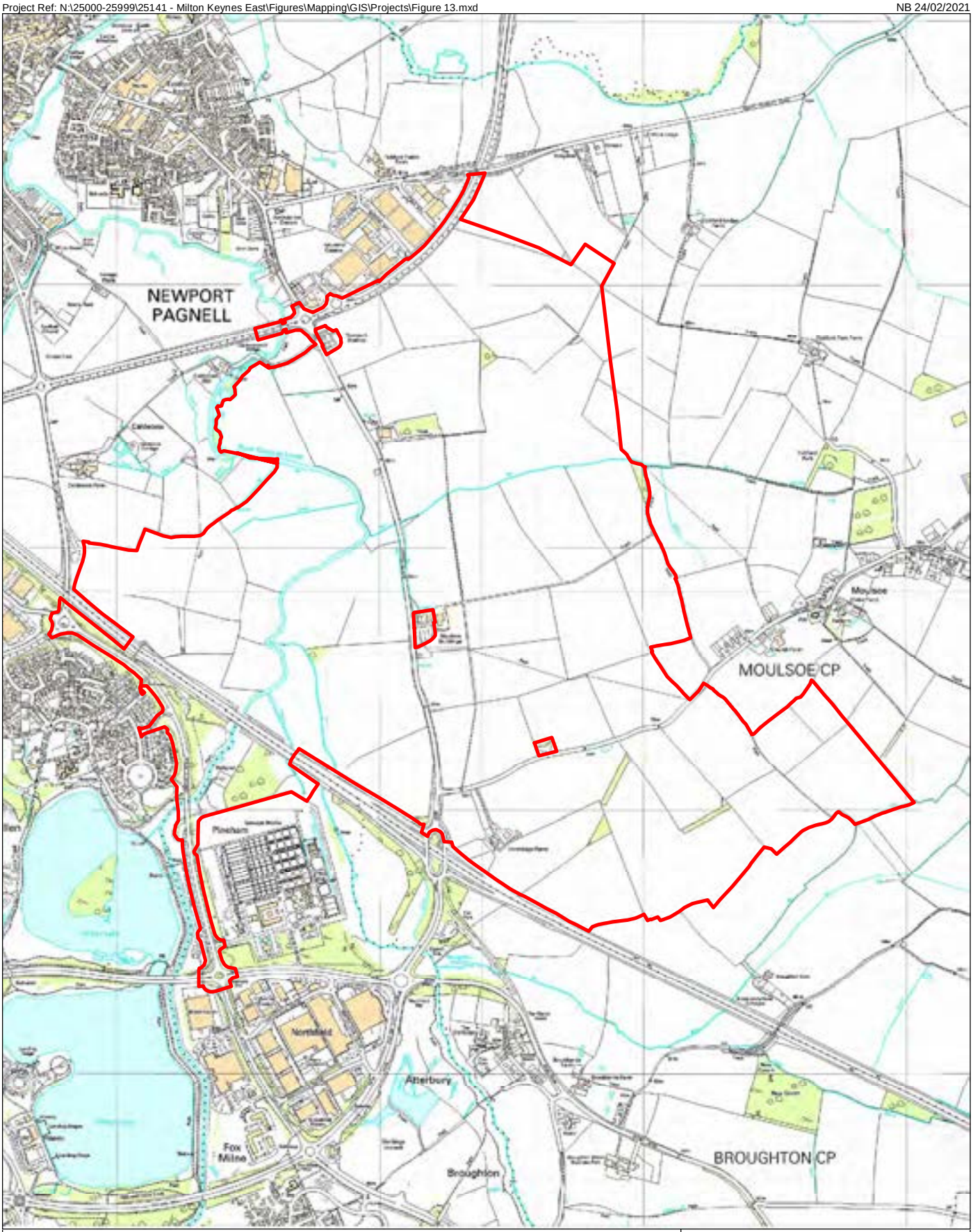
0 250 500 m

Scale at A4: 1:20,000

MAKING COMPLEX EASY

Figure 12

1963-70 Ordnance Survey Map (1:10,560)



Site Boundary

N

0 250 500 m

Scale at A4: 1:20,000

MAKING COMPLEX EASY

Figure 13

2002 Ordnance Survey Map (1:10,000)

Site Boundary

N

0 250 500 m

Scale at A4: 1:20,000

MAKING COMPLEX EASY

Figure 14

2003 Google Earth Image

Site Boundary

N

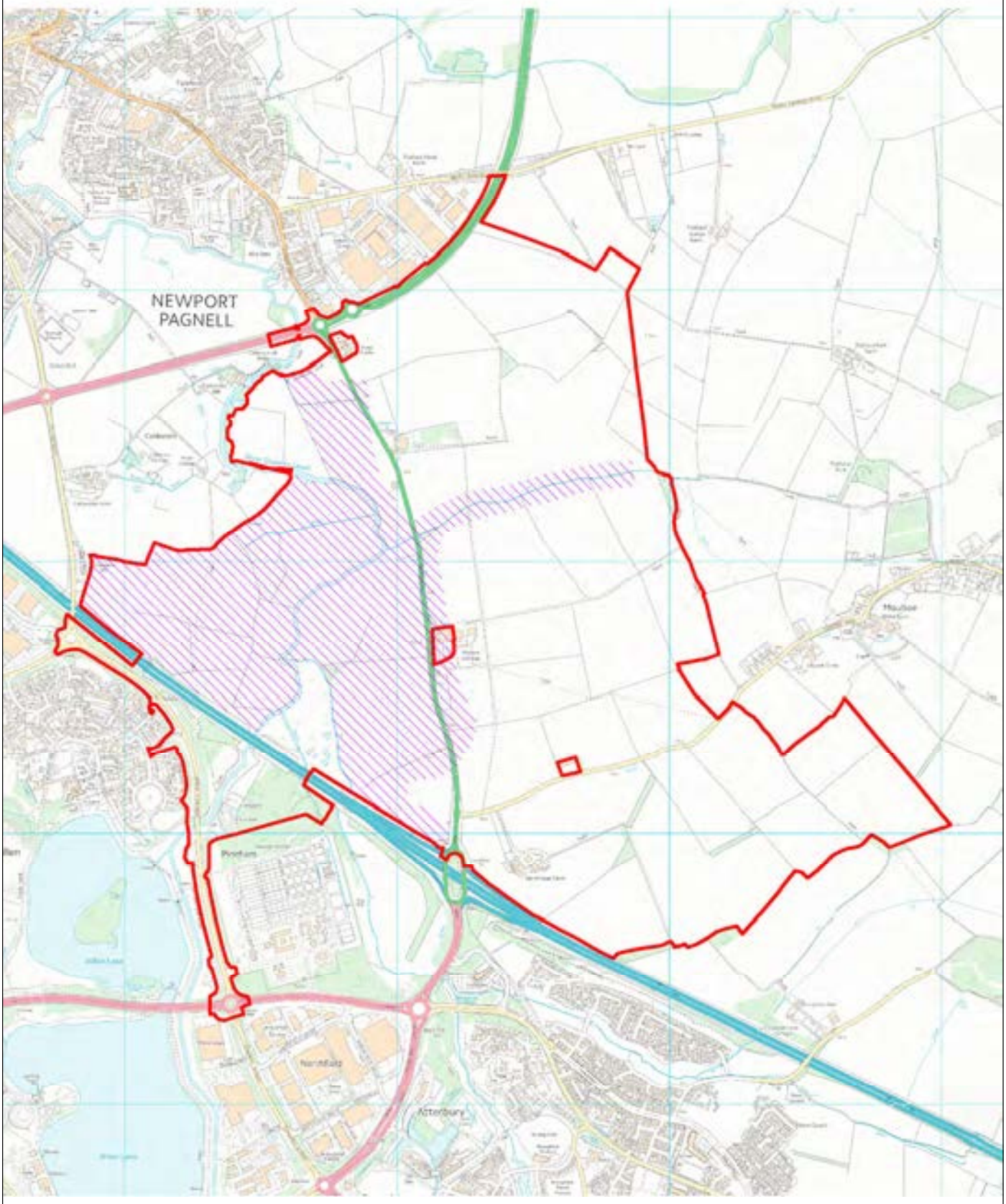
0 250 500 m

Scale at A4: 1:20,000

MAKING COMPLEX EASY

Figure 15

Site as Existing
(2018 Google Earth Image)



Site Boundary

Area of Early Prehistoric & Palaeolenvironmental potential associated with underlying Alluvial Deposits, River Terrace Gravels & Head Deposits

N

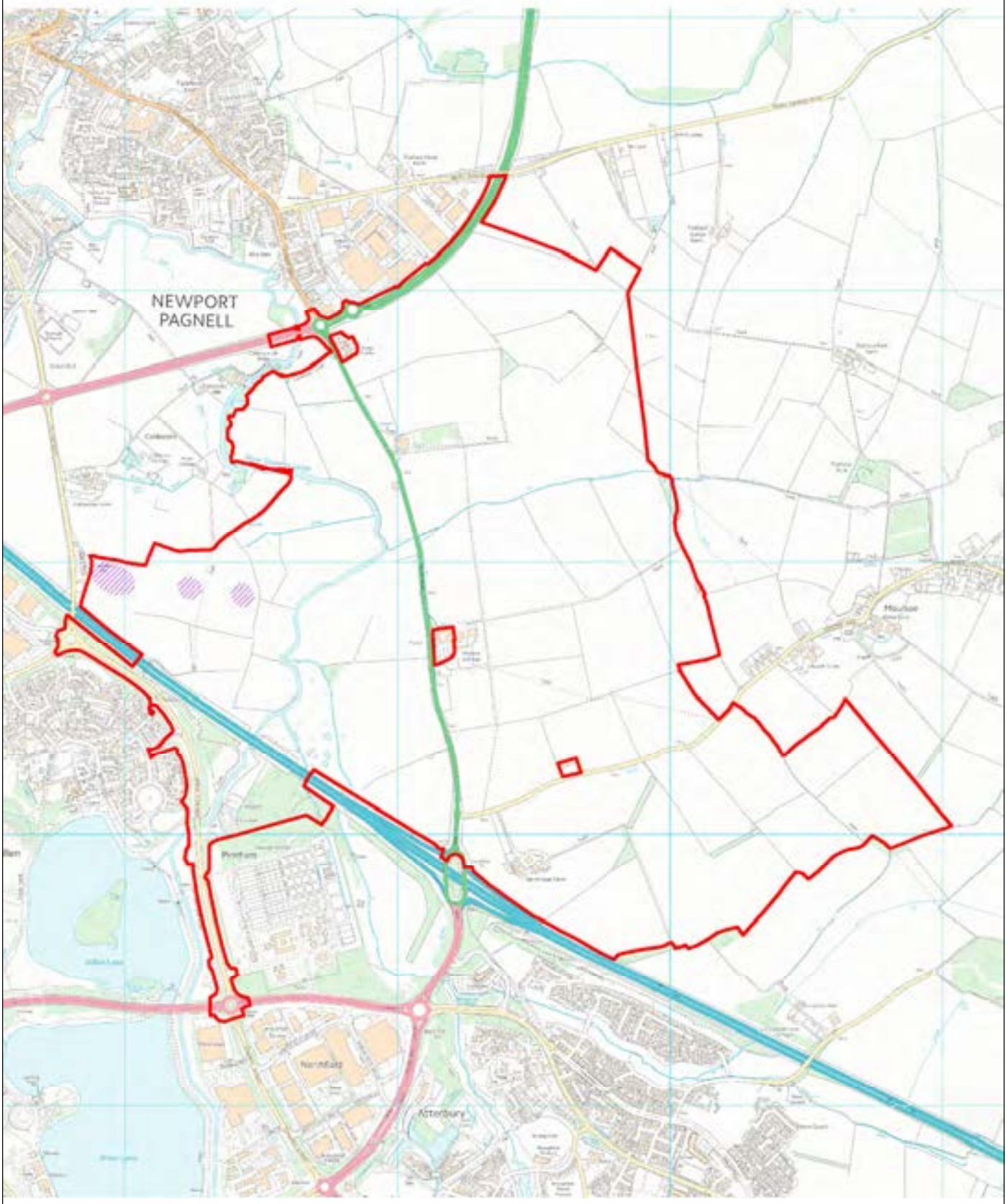
0 200 400 600m

Scale at A4: 1:20,000

MAKING COMPLEX EASY

Figure 16a

Likely Areas of Archaeological Potential: Palaeolithic and Mesolithic



Site Boundary

Area of potential associated with possible Bronze Age Ring Ditches

General Potential for artefactual evidence across site

N

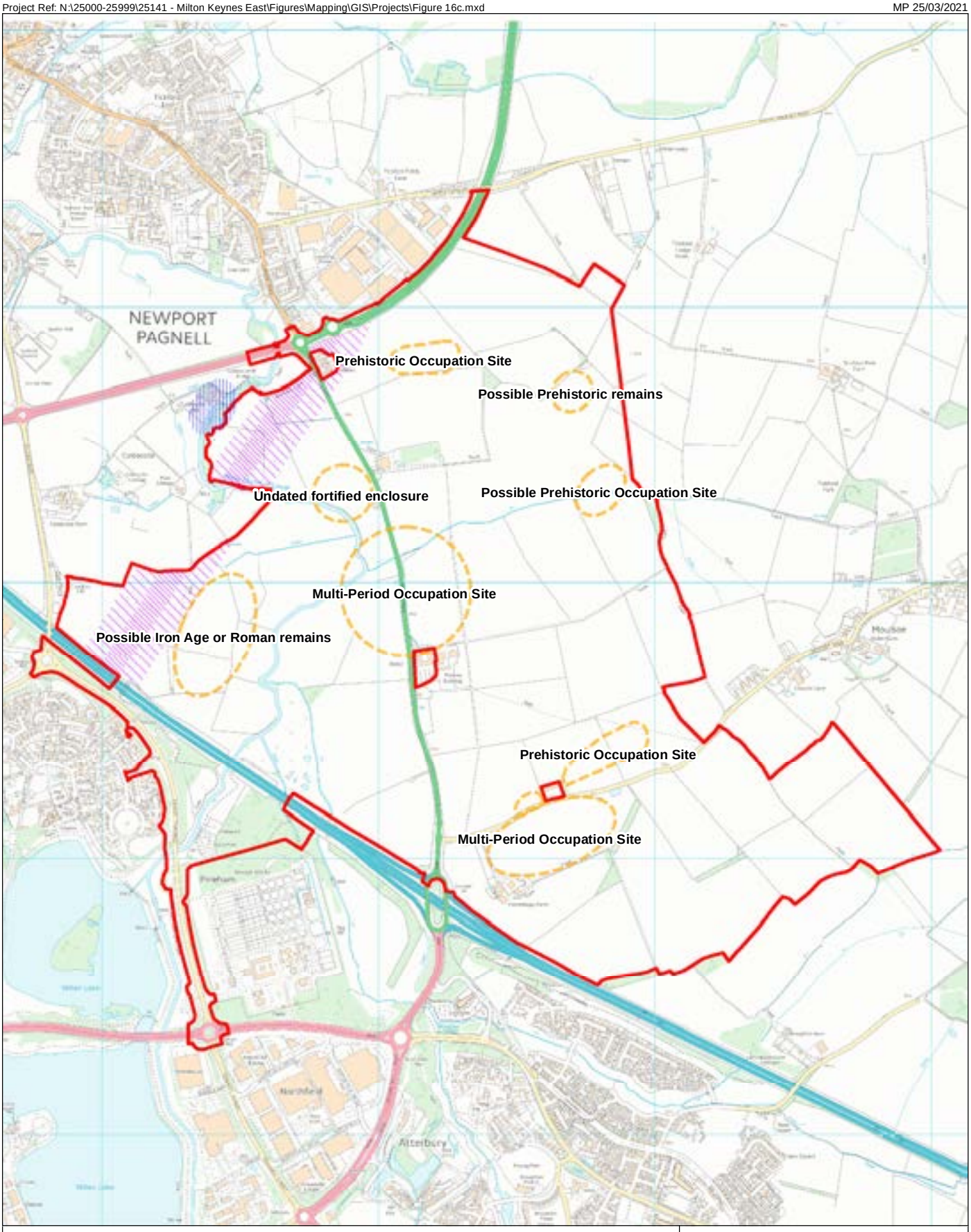
0 200 400 600m

Scale at A4: 1:20,000

MAKING COMPLEX EASY

Figure 16b

Likely Areas of Archaeological Potential: Neolithic and Bronze Age



Site Boundary

Area of potential associated with projected Roman road

Area of potential associated with projected Roman road & associated roadside activity

Area of possible Roman ford of the River Ouzel

General Potential for agricultural activity

Foci of Activity in Geophysical Survey

N

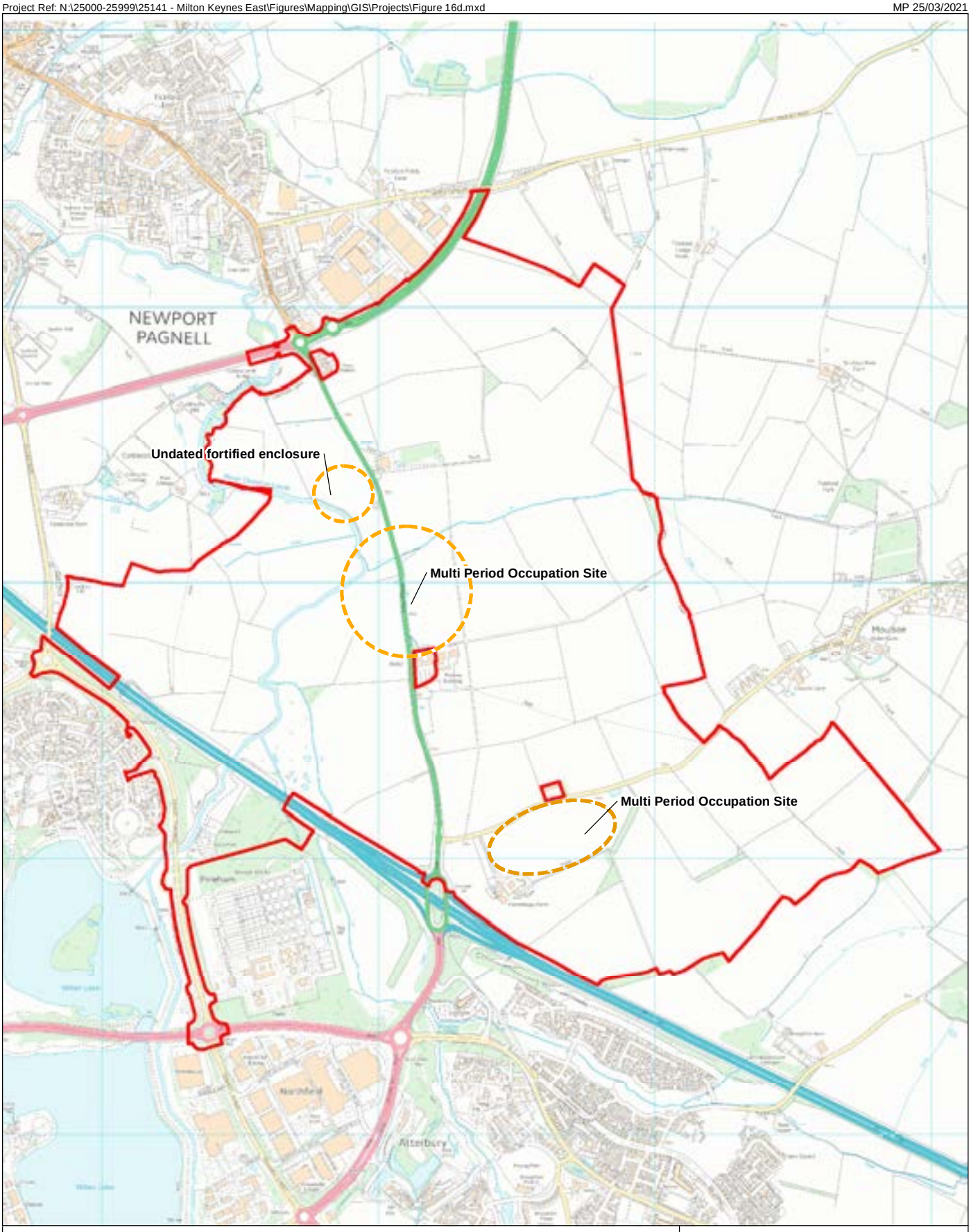
0 200 400 600m

Scale at A4: 1:19,000

MAKING COMPLEX EASY

Figure 16c

Likely Areas of Archaeological Potential: Iron Age and Roman



Site Boundary

General Potential for agricultural activity & land division

Foci of Activity in the Geophysical Survey

N

0 190 380 570m

Scale at A4: 1:19,000

MAKING COMPLEX EASY

Figure 16d

Likely Areas of Archaeological Potential: Saxon and Medieval

Site Boundary

Area of Brickworks & associated extraction

Area of potential associated with 19th century farmsteads

N

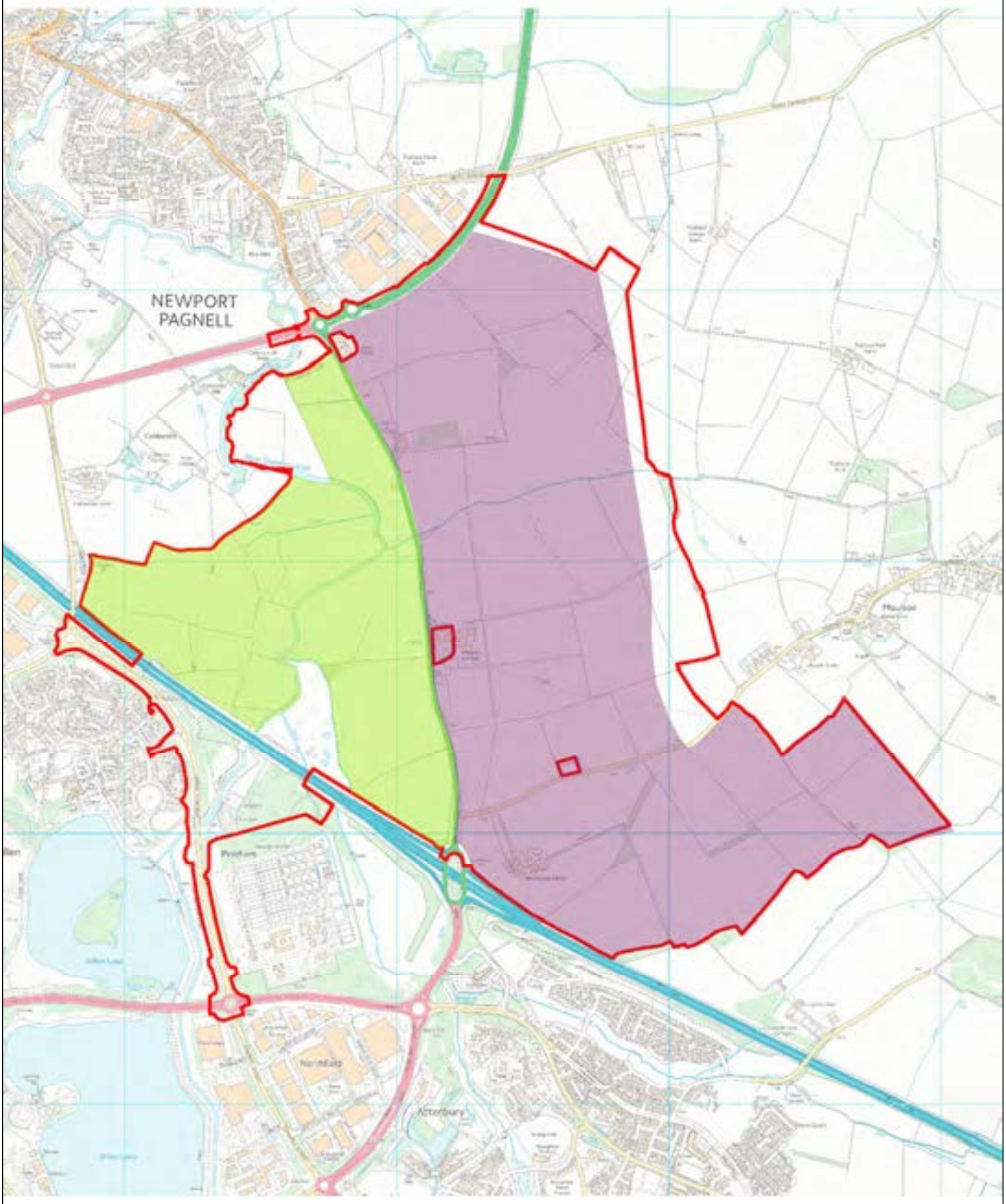
0 200 400 600m

Scale at A4: 1:20,000

MAKING COMPLEX EASY

Figure 16e

Likely Areas of Archaeological Potential: Post Medieval and Modern



Site Boundary
Area of well preserved Parliamentary Enclosure
Fragmentary Historic Landscape

N

0 200 400 600m

Scale at A4: 1:20,000

MAKING COMPLEX EASY

Figure 16f

Areas of Historic Landscape Potential

N

Ridge and Furrow
Extraction

Plate 1: Historic England Aerial Photo raf_cep_uk_1792_rs_4046 taken on 11th October 1946 showing north central area of study site

Plate 2: Historic England Aerial Photo raf_cep_uk_1792_rp_3047 taken on 11th October 1946 showing north central area of study site

N

Ridge and Furrow
Extraction

Plate 3: Historic England Aerial Photo raf_cep_uk_1926_rs_4263 taken on 16th January 1947 showing north west area of study site

Appendix 1

Land East of Milton Keynes Geophysical Survey Phase 1 March 2020

GEOPHYSICAL SURVEY

Land east of Milton Keynes, Buckinghamshire

25141
March 2020

rpsgroup.com

TABLE OF CONTENTS

1. LIST OF FIGURES

Figure 22	1:2000	Magnetometer Survey [Viewport 5] Interpretation
Figure 23	1:2500	Magnetometer Survey [Viewport 6] Greyscale Plots / Interpretation
Figure 24	1:10000	Magnetometer Survey [Minimally Processed] Greyscale Plots

2. SURVEY TECHNIQUE

Detailed magnetic survey (magnetometry) was chosen as the most efficient and effective method of locating the type of archaeological anomalies which might be expected at this site.

Bartington Grad 601-2	Traverse Interval 1.0m	Sample Interval 0.25m
Bartington Cart System	Traverse Interval 1.0m	Sample Interval 0.125m

3 SUMMARY OF RESULTS

3.1 The geophysical survey of an extensive tract of land to the north east of Milton Keynes has identified several archaeological sites, some of which were previously unknown, including two prehistoric occupation sites, an extensive Romano-British / Medieval settlement and a possible Viking encampment. The work has provided a clear plan of the varying remains and accurately marked their location on the base plans of the site.

4 INTRODUCTION

4.1 **SUMO Geophysics Ltd** were commissioned to undertake a geophysical survey of an area outlined for comprehensive development. This survey forms part of an archaeological investigation being undertaken by **RPS Group.**

4.2 Site details

NGR	SP 89360 41790
Location	The site is located north east of Milton Keynes. The total site is approximately 362ha in extent, of which a sample was selected for geophysical investigation (see Fig 01).
HER	Milton Keynes
District	Borough of Milton Keynes
Parish	Moulsoe CP
Topography	The River Ouzel meanders north-south through the site; land to the west of the floodplain rises gently to c.65m AOD at the far western corner, whilst the topography of the eastern half of the site generally comprises land sloping down towards the river valley, and away from an area of high ground at Moulsoe.
Current Land Use	Mixed agriculture
Geology (BGS 2020)	Bedrock: Kellaways Formation - Sandstone, Siltstone and Mudstone. Superficial: Head - Clay, Silt, Sand and Gravel; Felmersham Member - Sand and Gravel. Alluvium - Clay and Silt. Oadby Member – Diamicton Alluvial deposits are located within the immediate vicinity of the River Ouzel in the western half of the site, whilst gravel terraces and head deposits associated with the river valley are recorded either side of the river.
Soils (CU 2020)	West and east of R Ouzel: Soilscape 8 - slightly acid loamy and clayey soils with impeded drainage R Ouzel valley: Soilscape 20 - loamy and clayey floodplain soils with naturally high groundwater East of London Road: Soilscape 9 - lime-rich loamy and clayey soils with impeded drainage
Archaeology (CgMs 2018)	The background archaeology is summarised in the draft desk-based assessment prepared by CgMs, now RPS. Extracts from this document are included in the results sections where entries in the HER are referenced in relation to the magnetic results.
Survey Methods	Magnetometer survey (fluxgate gradiometer)
Study Area	170 ha

4.3 **Aims and Objectives**

To locate and characterise any anomalies of possible archaeological interest within the study area.

5 RESULTS

The survey has been divided into twenty-eight survey areas (Areas 1-28) and specific anomalies have been given numerical labels [1] [2] *which appear in the text below, as well as on the Interpretation Figure(s).*

5.1 *Probable / Possible Archaeology*

Area 1

5.1.1 There is a wide cluster of poorly defined anomalies [1] in the north-west corner of Area 1; they comprise incomplete rings, small arcs and pit-like responses. They would appear to correspond with cropmark evidence for possible Bronze Age ring ditches and barrow cemeteries (HER Refs: MMK502, MMK504, MMK929-30 & NMR Ref: 345028).

5.1.2 A well-defined, irregularly-shaped ditched enclosure [2] has maximum dimensions of approximately 30m by 15m; there may be internal features, but these responses could be part of the complex [1]. The results are thought to equate with an undated enclosure (NMR Ref: 915527) recorded in the HER.

2

NTS

5.1.3 Linear and intermittent responses appear to indicate two possible rectilinear enclosures [3] and [4], on slightly differing alignments. It is unclear whether either of the potential enclosures is associated with [2].

5.1.4 Several small pit-like anomalies are visible in the data [5]; they extend over an area some 150m across but there are no signs of any associated ditches or enclosures. The features are near to cropmark recorded positions of Bronze Age ring ditches and barrow cemeteries [HER: MMK504]; although there are some very feint arcs in the data, the magnetic responses would not be interpreted as being archaeological. The HER also records an undated linear cropmark [HER: MMK505] at this location. Whether this linear cropmark relates to the projected line of the Roman Road [NMR: 868140], thought to pass through the field at this point is not totally clear, but nothing is visible in the magnetic data (however, see 5.1.5 below).

5.1.5 Some 200m east of the projected Roman Road there is a linear, ditch-like anomaly [6] which crosses Area 1 on a NNE-SSW alignment and continues into Area 4; this is roughly parallel to the line of the Road. There is a second length of ditch visible in the data [7] set some 25m to the east of [6] but it is at a slightly divergent angle. Therefore, it is probably unlikely that [7] represents a roadside ditch, but more likely an old land division.

5.1.6 Adjacent to ditch [7] in Area 1 there is a well-defined ring [8] which is not quite circular; it measures 23m by 26m but doesn't appear to have a break in the ditch. It is not possible to determine its exact relationship, if any, with [8].

The ring would appear to be a Bronze Age barrow according to local records (HER: MMK 929 & NMR:1588616).

5.1.7 Lying south of the postulated barrow [8] there are rectilinear responses which are described below in Area 4 (see 5.1.10).

5.1.8 Close to the M1 motorway in Area 4 there is a series of faint linear / curvilinear and rectilinear trends in the data [11] along with some possible pit-like responses. Previous archaeological evaluation work was undertaken along the route of the M1 which identified evidence for Iron Age and Roman ditches, pits and possible occupation (NMR Ref: 1324853) at the same location as these magnetic responses.

Areas 2 and 3

5.1.9 Weak linear trends, which appear to form a regular rectilinear pattern, are just visible in the data from these two areas. They may be of archaeological interest, but the results are partially obscured by the strong ridge and furrow anomalies.

Area 4

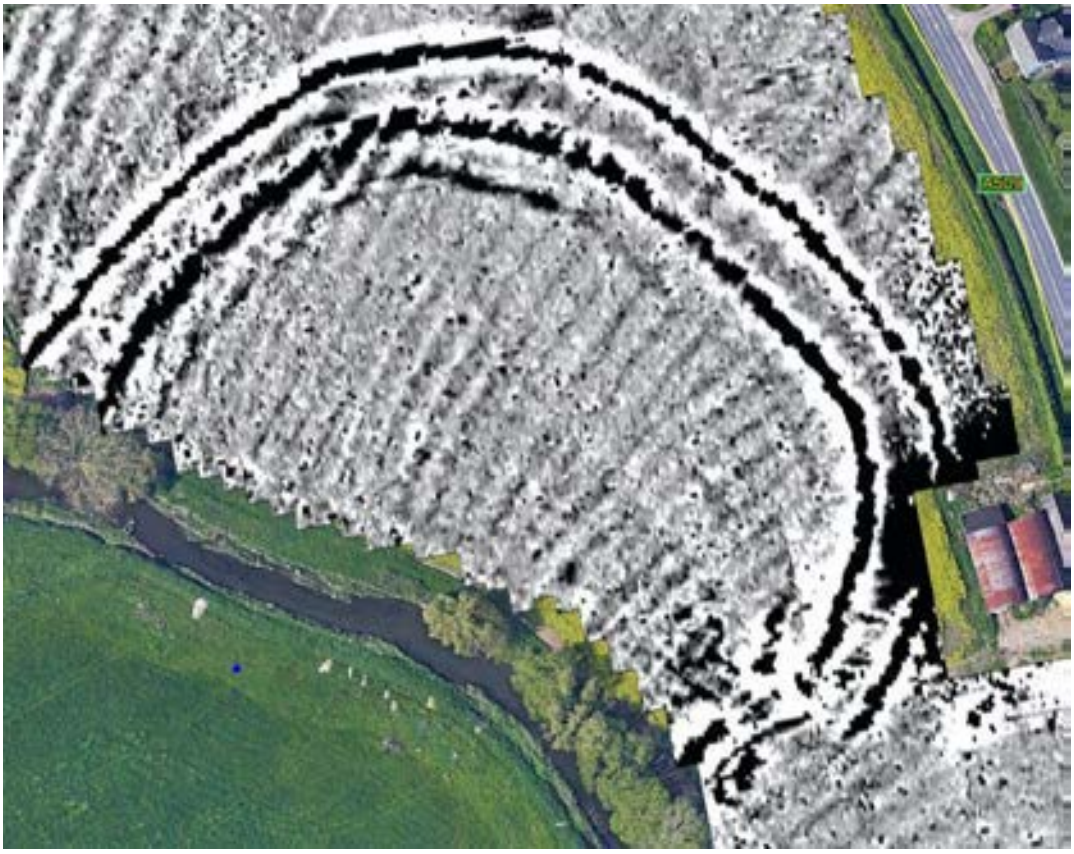
5.1.10 Immediately east of the linear anomaly [6] there is a complex of rectilinear enclosures in Area 1 [9] and Area 4 [10] on the same alignment as the ditch, but partially obscured by ridge and furrow cultivation and a modern pipeline. The results would seem to indicate a small settlement or farmstead with fields, paddocks and trackways. An Iron Age or Romano-British date might be appropriate as it appears to underlie the ridge and furrow.

Areas 5 and 6

5.1.11 Apart from agricultural features and ridge and furrow cultivation, there are no identifiable responses of definite archaeological interest.

Area 7

5.1.12 Some remarkably clear magnetic responses have been identified in this area which overlooks the River Ouzel. The anomalies [12] comprise a series of ditches and associated banks which form a multivallate, fortified enclosure, with the river providing the southern defences.



NTS

The enclosure has maximum dimensions of 210m by 120m and there appears to be a single entrance in the south. There is a break in the ditches at this point and there is an arrangement of defensive banks and ditches. Immediately inside the enclosure there are rectilinear anomalies [13] which appear to indicate building foundation trenches measuring at least 13m across and comprising at least two sections. Apart from this possible structure, the interior of the fortification has no obvious archaeological features, however ridge and furrow cultivation is clearly visible throughout the survey area. This cuts into the defences and may have damaged any internal features. The results correspond with the location a of possible curvilinear cropmark enclosure recorded in the HER (MMK3823). One interpretation for the date and function of the site is that it could equate to a Viking encampment. The footprint of the defences is very similar to that at Repton, Derbyshire, where there was also a river forming the fourth side of the defences. At Repton the tower of Anglo-Saxon church was incorporated into the gatehouse; it is tempting to interpret the anomalies [13] as representing a similar arrangement.

5.1.13 Approximately 110 metres to the south of the above enclosure are further features of archaeological interest; these will be described later with Areas 15 and 16.

Area 8 (extending into Areas 9 and 11)

5.1.14 The results from these areas indicate a complex of archaeological features [14] comprising ring ditches, enclosures and a probable trackway. The ring ditches are presumed to be gullies associated with round houses; some appear to be set within their own enclosure or compound, others are set apart and some are joined in pairs by a short ditch length. The complex extends over 400m east-west and is likely to indicate a small prehistoric settlement; the site does not appear to be recorded in the HER. Some of the houses appear to overlap with each other indicating multi-phased occupation.

NTS

Area 9

5.1.15 Feint linear and rectilinear trends in the data [15] are on a different alignment to the ridge and furrow cultivation patterns and as such could indicate former enclosures but there is no clear evidence for internal features such as ring ditches or pits. Unfortunately, in addition to the ploughing partially obscuring the results, a large service pipe runs straight through the middle of the potential area of interest.

Area 10

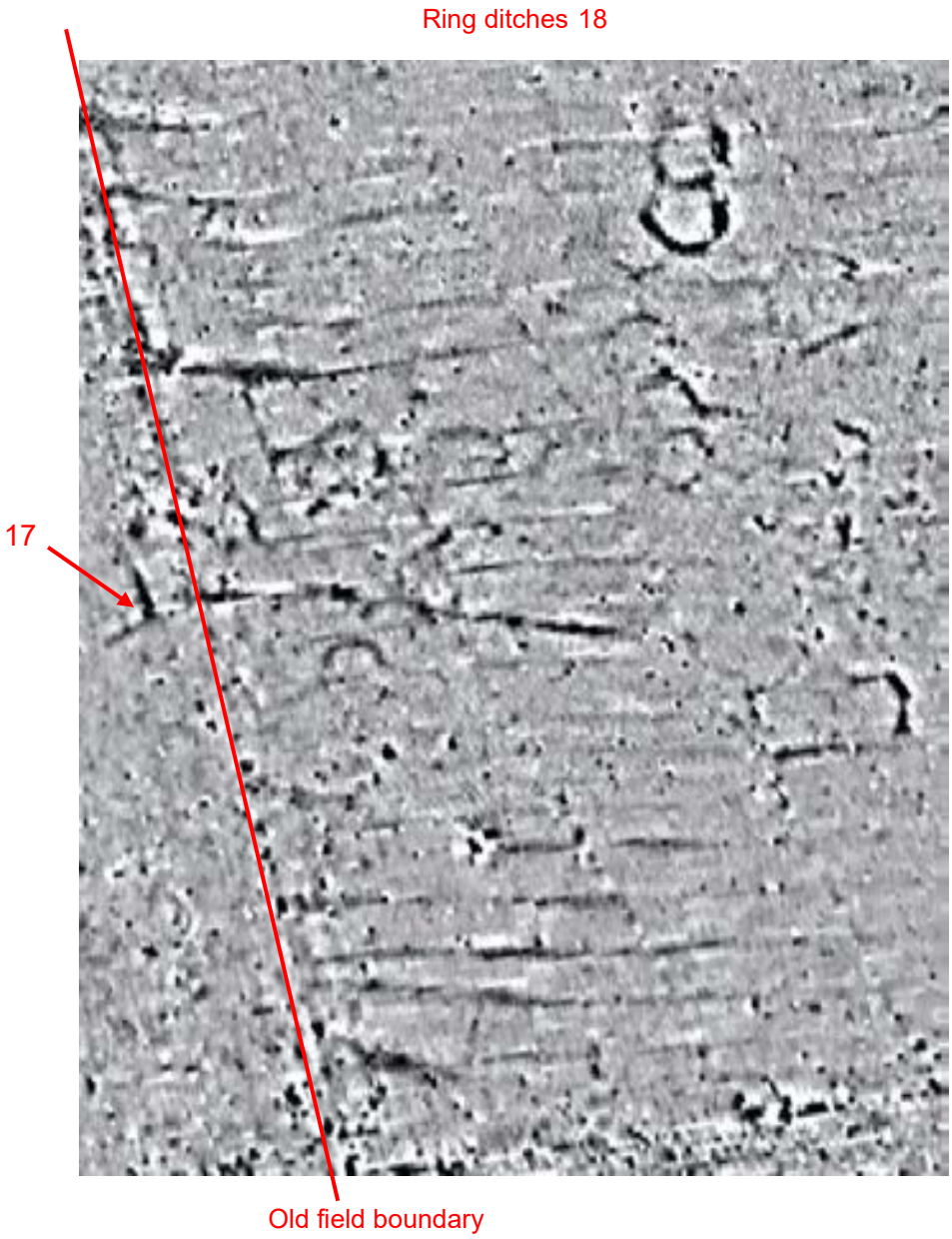
5.1.16 There are no responses indicative of archaeological features in this area.

Area 11

5.1.17 A small rectangular area of slightly increased magnetic response [16] is visible on aerial imagery in 2010 (Google Earth©). The exact cause of this is uncertain, though it could be associated with the brickworks which lay immediately to the south (HER: MMK3400) and might have been an extraction pit.

5.1.18 The early 19th century enclosure map for Tickford notes a 'Mill Field' which may indicate a possible windmill within this area (HER: MMK3385). Such features can be very difficult to identify in geophysical data, as in some cases the remnants of the structure tend to comprise simply of cross-shaped beam slots. There is one anomaly [17] which is close to the marked location; it lies immediately west of an old field boundary and could be of interest (see image below). Without the reference to the windmill it is unlikely that the anomaly would be highlighted; it could simply be part of the complex to the east. Just west of the windmill, there is a curvilinear enclosure is noted in the HER as a cropmark (MMK978) but there are no indications of such a feature in the magnetic data.

5.1.19



In the eastern half of Area 11 there are several poorly defined rings, arcs and short linear responses [18]; it is possible that the associated features have been truncated by the ridge and furrow ploughing visible in the data. The responses are likely to be former round houses (associated with the complex identified above in 5.1.14) or possibly round barrows as these are recorded elsewhere on the site. The number of pit-like responses would tend to favour settlement rather than burial activity.

Area 12

5.1.20 There are no responses indicative of archaeological features in this area.

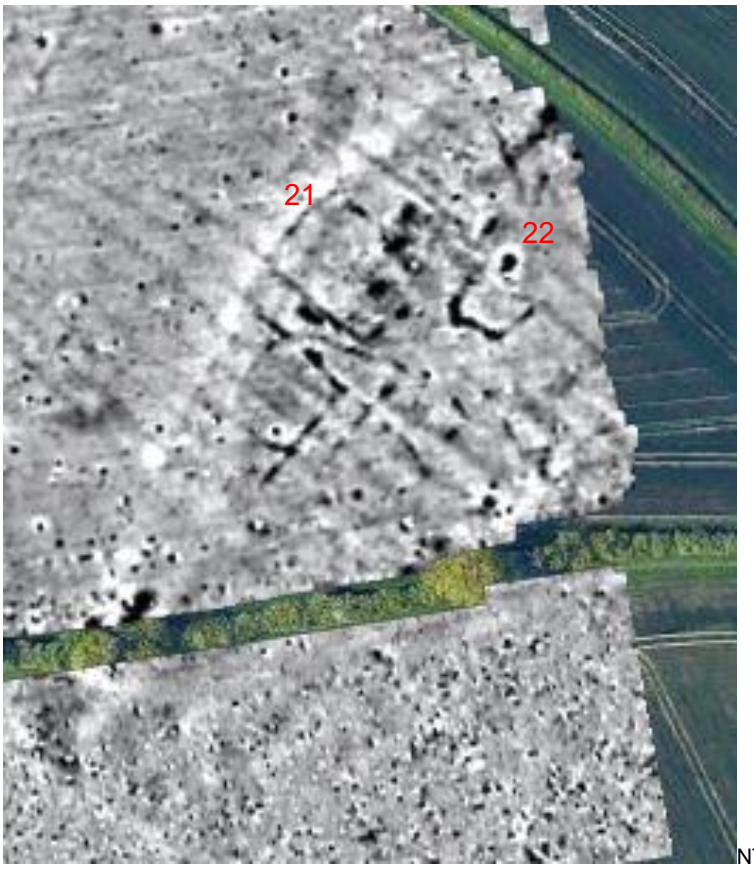
Area 13

5.1.21 This area lies immediately to the south of the brickworks (HER: MMK3400 – see 5.1.17) and is recorded on the Tickford enclosure plan as containing allotments (marked as geometric patterned fields). It is unclear whether the anomalies [19] are associated with these divisions or earlier archaeological field systems, hence their uncertain interpretation. There is a linear magnetic anomaly in the data, on a slightly differing alignment, which clearly relates to a field boundary marked on more recent maps than the Tickford plan.

Areas 14, A, B, C and D

5.1.22 In the north of Area 14 there are ring-shaped anomalies, arcs and trends which form a small focus of features [20] which are of archaeological interest. Although not as well-defined as some of the other examples highlighted in this report, the results are not dissimilar to those found less than 400m to the west in Areas 8 and 11.

5.1.23 In the south-eastern extremity of Area 14 and extending into Area 14D is a curving band of negative magnetic responses [21], which may be indicative of a former bank, now ploughed out. This feature appears to define the northern limits of some small enclosures and several strong magnetic anomalies including one possible kiln-like feature [22].



NTS

Areas 15 and 16 (plus Area 7 south)

5.1.24 The results from these three areas indicate a plethora of archaeological type anomalies [23] extending over an area in excess of 12 hectares; this does not cover the whole settlement which appears to continue beyond the survey limits to the west and may well have originally

covered some 18 hectares in size. This is similar to Wharram Percy, North Yorkshire, the location of one of the largest geophysical surveys carried out by English Heritage (Linford and Linford 2003). The results from the two sites bear a remarkable similarity in both the nature of the magnetic anomalies and their postulated origins. At Wharram the results identified phases of activity presumed to date from the Iron Age and Romano-British periods, continuing through Saxon times and into the medieval period.

NTS

This interpretation can be similarly applied to the current magnetic data. The results fall broadly into two categories; enclosures and trackways which follow a planned rectilinear pattern and have a greater magnetic strength; and more recent enclosures (crofts) which are irregular in shape with curvilinear boundaries and generally less strong anomalies. The former are likely to be Romano-British and the latter medieval, though there are clearly features which overlap in date. It is noticeable that the ridge and furrow cultivation in the north and west ‘overlies’ many of the responses. In amongst the results there are several anomalies which indicate probable ovens and kilns or perhaps metalworking zones.

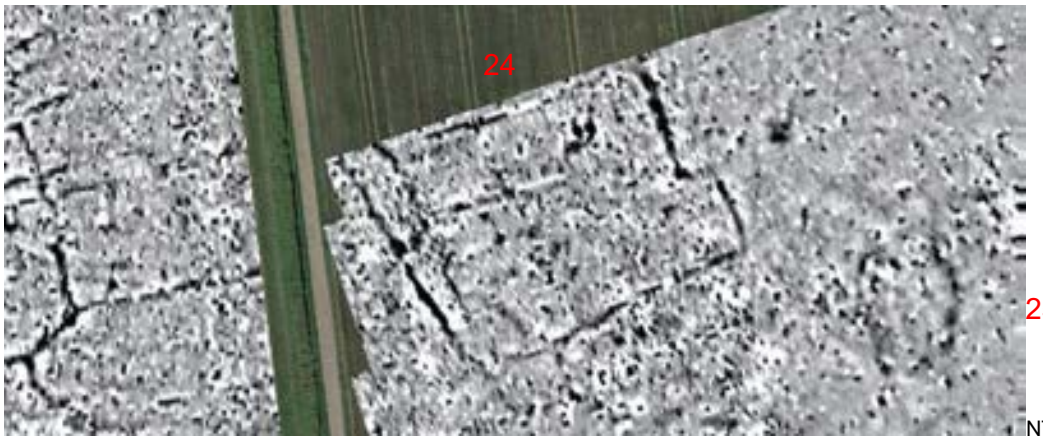
Areas 17, 18, 19, 20 and 21

5.1.25 There are no responses indicative of archaeological features in these areas.

Area 22

5.1.26 Originally a sample block, this area was expanded when anomalies were recorded along the western edge of the survey. The extended results reveal a rectilinear enclosure [24] in the north-west corner, though unfortunately the full limits have not been defined. Two linear anomalies 'inside' the enclosure appear to be a continuation of strip fields mapped in Area 15 to the west.

5.1.27 East of the above enclosure is an irregular shaped anomaly [25] indicating a ditched feature some 50m by 40m in size. It is not clear if there are breaks in the northern and southern sides; an old field boundary clips the northern part of the feature.



NTS

Areas 23 and 24

5.1.28 There are no responses indicative of archaeological features in these areas.

Area 25

5.1.29 Apart from artefact scatters (HER: MMK3982), the image below indicates a previously unrecorded complex of archaeological features [26]. The clarity of the results speaks for itself; a series of rectilinear enclosures, trackways, ring ditches, pits and ditches indicate a settlement, of presumed prehistoric date, which extends over some 5 hectares. Although there are 'classic' thermoremanent anomalies in the results, some of the responses could indicate fired / burnt features – perhaps ovens or smaller kilns. The evidence would seem to indicate multi-phased activity.

NTS

Areas 26, 27 and 28

5.1.30 There are no responses indicative of archaeological features in these areas apart from the continuation of a possible ditch identified in Area 22 above.

5.2 ***Uncertain***

5.2.1 There are a few uncertain linear responses and trends in the data, as is inevitable in a survey of this size.

5.3 ***Former Field Boundary***

5.3.1 A number of linear anomalies in the data coincide with former field divisions shown on historic mapping and, in these instances, they have been earmarked as corroborated. Other linear responses which follow existing field alignments or run across 'modern' fields have been interpreted as conjectural old boundaries.

5.4 ***Agricultural – Ridge and Furrow / Land Drains***

5.4.1 Whilst evidence for Medieval ridge and furrow agricultural activity is noted by the HER in the far western extent of the study area (NMR: 915523), historic aerial photographs indicate that ridge and furrow can be seen across much of the study site. The magnetic survey has also identified extensive ridge and furrow cultivation throughout the survey areas. Figure 06 shows the georeferenced cultivation patterns extracted from the interpretation of the results.

5.4.2 Networks of land drains, some following classic herringbone patterns, are visible in many of the fields, specifically Areas 8, 11, 14, 21, 24, 26 and 27.

5.5 *Service Pipes – Cables*

5.5.1 A number of services have been identified in the survey data:

- In Areas 1, 4 and 5 there is a straight positive linear anomaly with an associated strong negative halo; the anomaly spans a width of 40m. The response is unusual in that there are no obvious joints; it might be a conduit rather than a pipe. It could be associated with the quarry to the north at Caldecote Farm, or the sewage farm at Pineham to the south.

- A second pipe runs through Areas 1 and 4; the anomaly is also positive with a negative halo, though in this instance there are breaks, associated with the joints in the pipeline. It also may serve the quarry or sewage works.

- A network of smaller pipes is visible in Areas 9, 12 and 14; they have resulted in a characteristic chain of dipole anomalies. Some of the pipes appear to stop abruptly, in the middle of fields, hence they may have been connected to drinking troughs.

- Another pipe crosses Area 25 and follows the line of a former track / boundary across the field.

5.6 *Magnetic disturbance*

5.6.1 By comparison with the other survey areas there is a marked increase in background magnetic noise levels. The data suggest that perhaps some form of green waste has been spread over the fields and this has resulted in the erratic responses.

5.6.2 A broad band of magnetic disturbance in Area 10 is thought to be associated with the construction of the two roundabouts lying adjacent to the field to the north; they may indicate a former construction compound.

5.6.3 The whole of the south-western half of Area 26 is magnetically disturbed; there is a visible change in the field which coincides with the disturbance. The ground appears to have been artificially landscaped and could be associated with the construction of the M1 to the south west.

5.7 *Ferrous*

5.7.1 Ferrous responses close to boundaries are due to adjacent fences and gates. Smaller scale ferrous anomalies ("iron spikes") are present throughout the data and are characteristic of small pieces of ferrous debris (or brick / tile) in the topsoil; they are commonly assigned a modern origin. Only the most prominent of these are highlighted on the interpretation diagram.

6 DATA APPRAISAL & CONFIDENCE ASSESSMENT

6.1 Historic England guidelines (EH 2008) Table 4 states that the typical magnetic response on the local soils / geology is variable. The results from this survey indicate the presence of a number of sites of archaeological interest along with extensive evidence for ridge and furrow cultivation across the areas investigated. The survey can be deemed to have worked successfully.

7 CONCLUSION

7.1 The magnetometer survey on land lying north east of Milton Keynes has successfully mapped several archaeological sites, some of which were previously known and some which are new discoveries. The range in sites spans from Bronze Age burial and settlements, to Iron Age / Romano-British farmsteads and settlements, a possible Viking encampment, a deserted medieval village and medieval / post-medieval ridge and furrow cultivation regimes. Additionally, former field boundaries, land drains and services have been mapped.

8 REFERENCES

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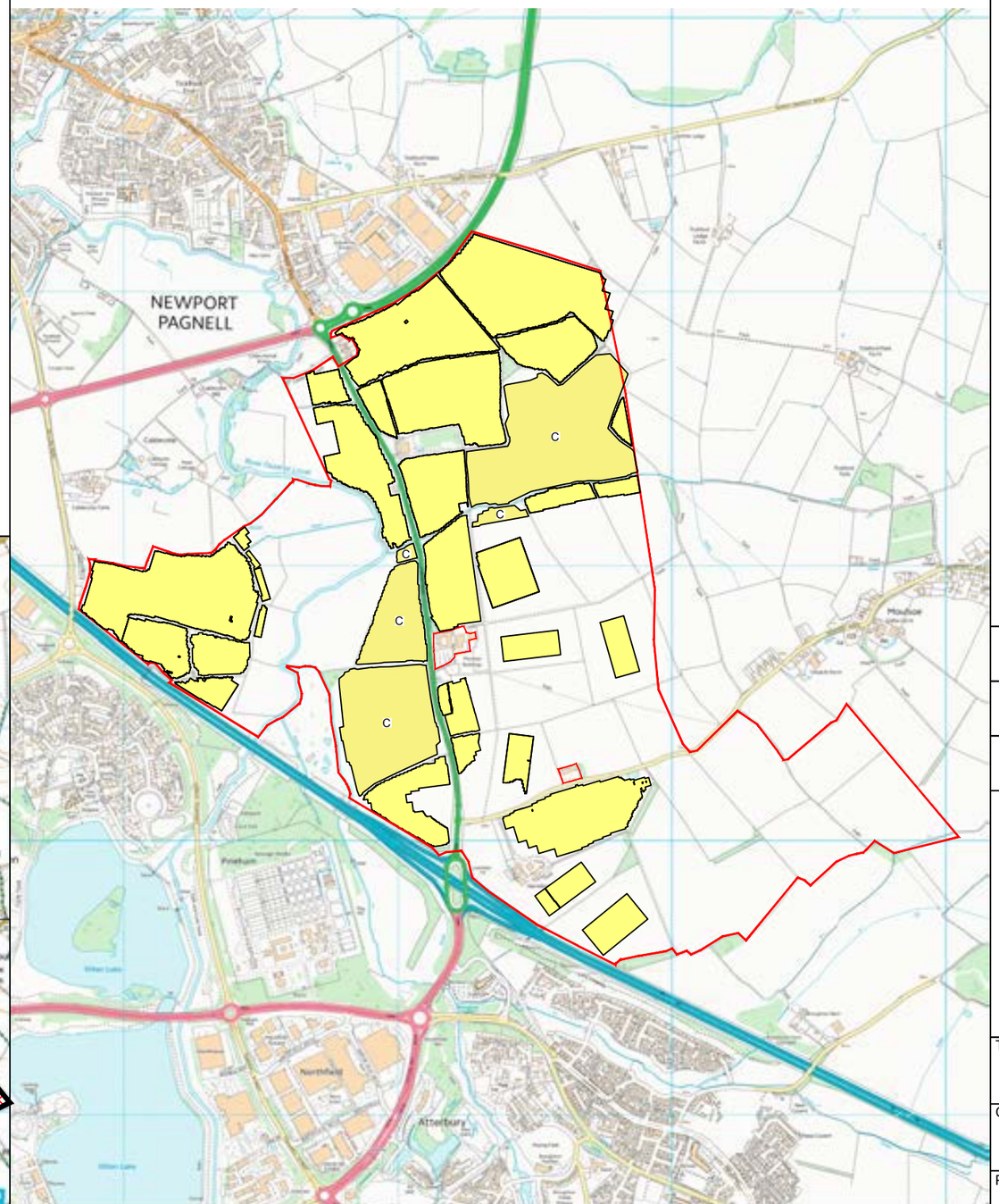
Linford, P. and Linford, N. 2003 *WHARRAM PERCY, North Yorkshire: Report on geophysical surveys, 1984-2002.* Centre for Archaeology Report 28/2003, English Heritage. ISSN 147309224



N

	Site Location
	Magnetometer Survey (Handheld)
C	Magnetometer Survey (Cart)

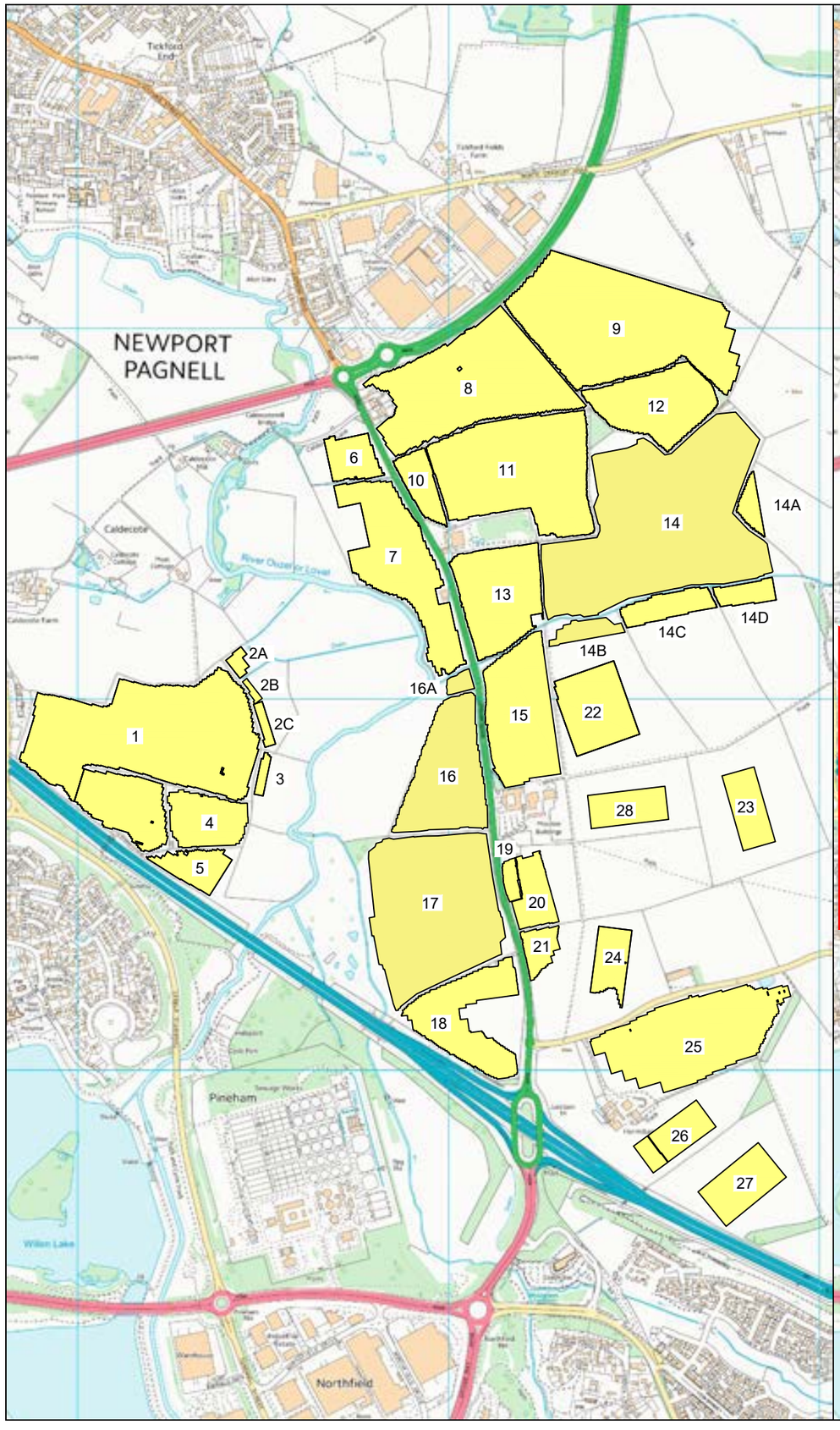
Title: Site Location

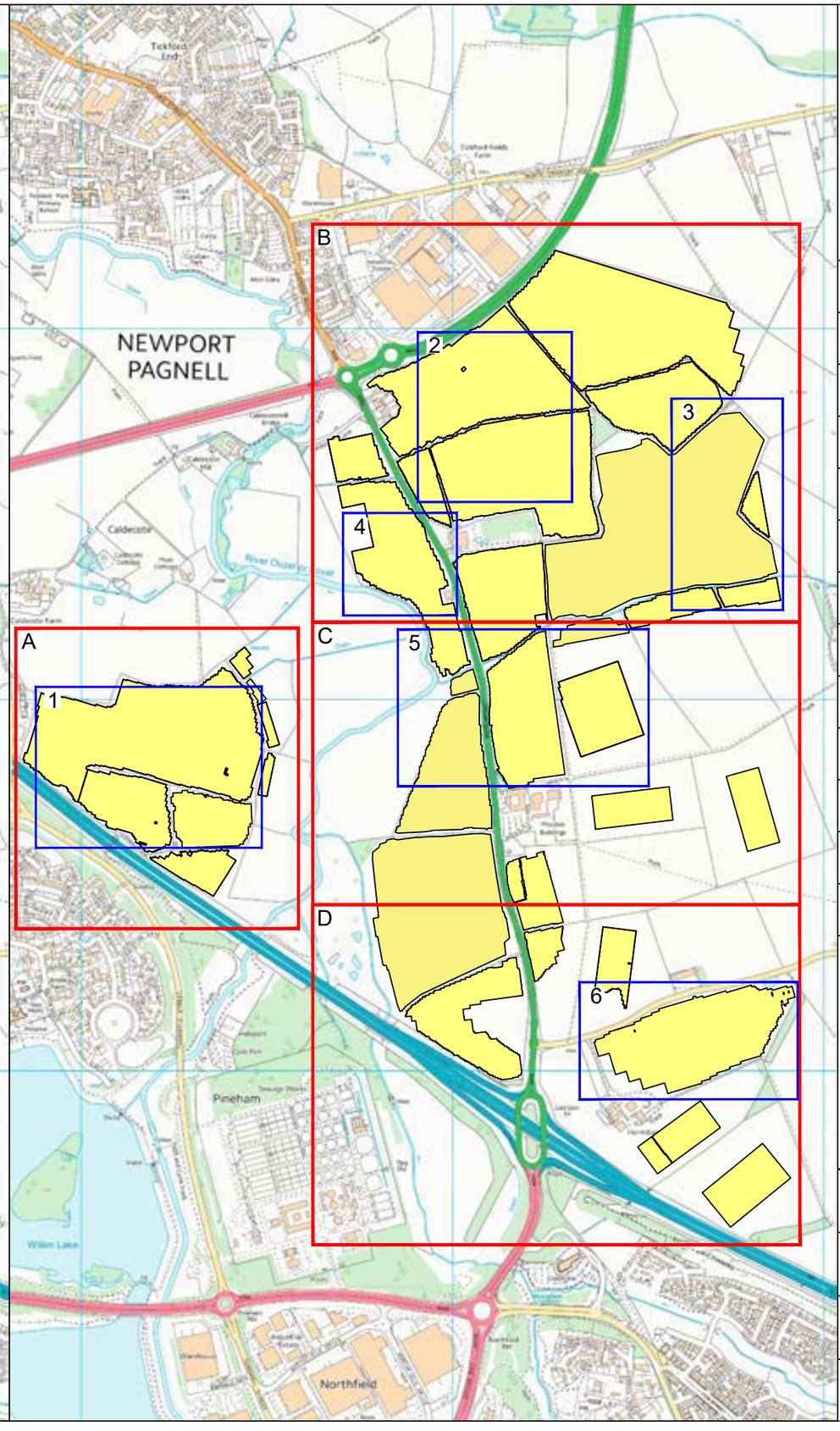
Client: RPS Group

Project: 16937 Land East of Milton Keynes, Buckinghamshire

not to scale

Fig No: 01





N

Viewports

Red	
A	Figure 07 and 08
B	Figure 09 and 10
C	Figure 11 and 12
D	Figure 13 and 14
Blue	
1	Figure 15 and 16
2	Figure 17 and 18
3	Figure 19
4	Figure 20
5	Figure 21 and 22
6	Figure 23

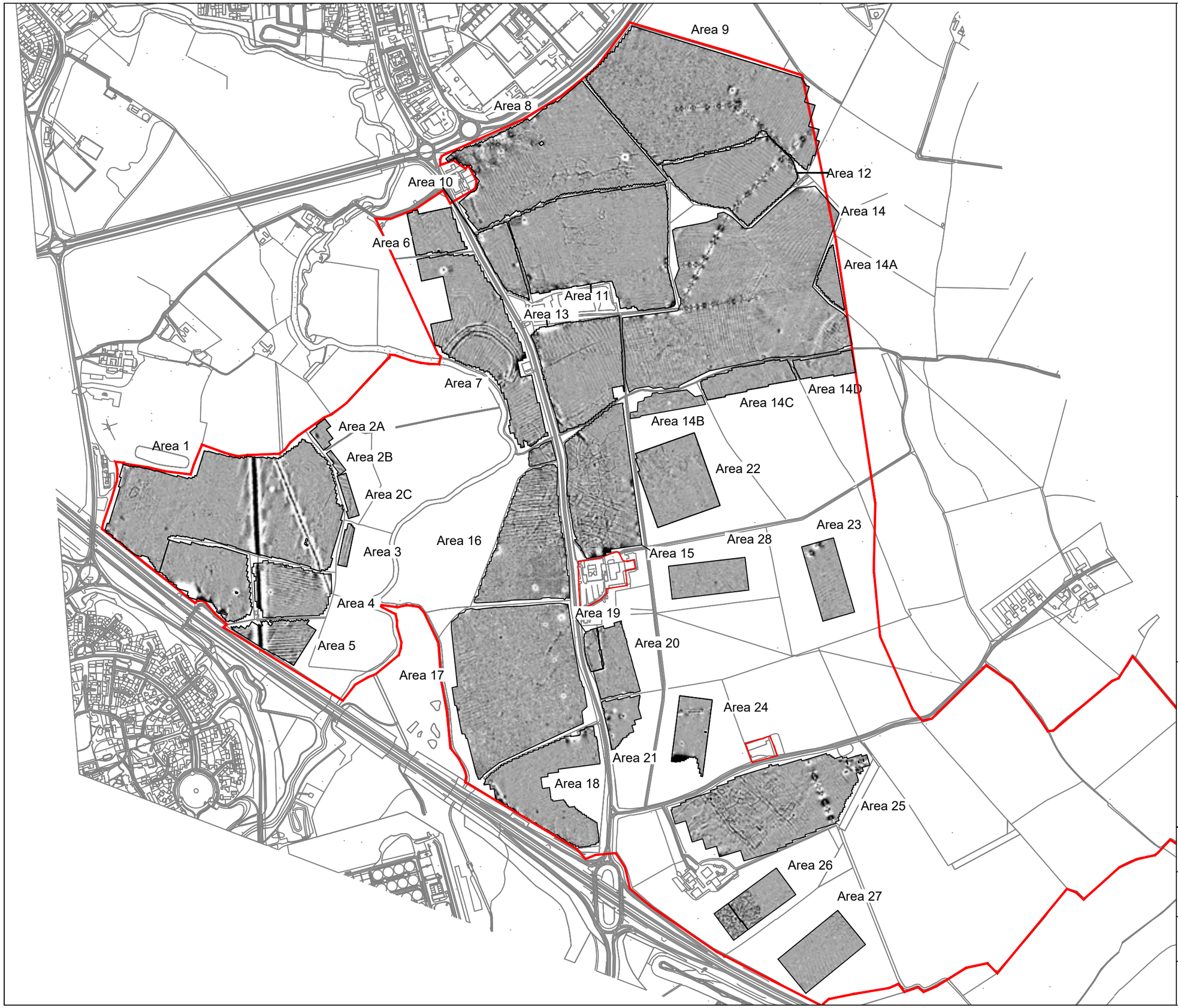
Title:
Magnetometer Survey Areas

Client:
RPS Group

Project:
16937 Land East of Milton Keynes, Buckinghamshire

Scale:
0 metres 700
1:14000 @ A3

Fig No:
02



N

2
nT
-1

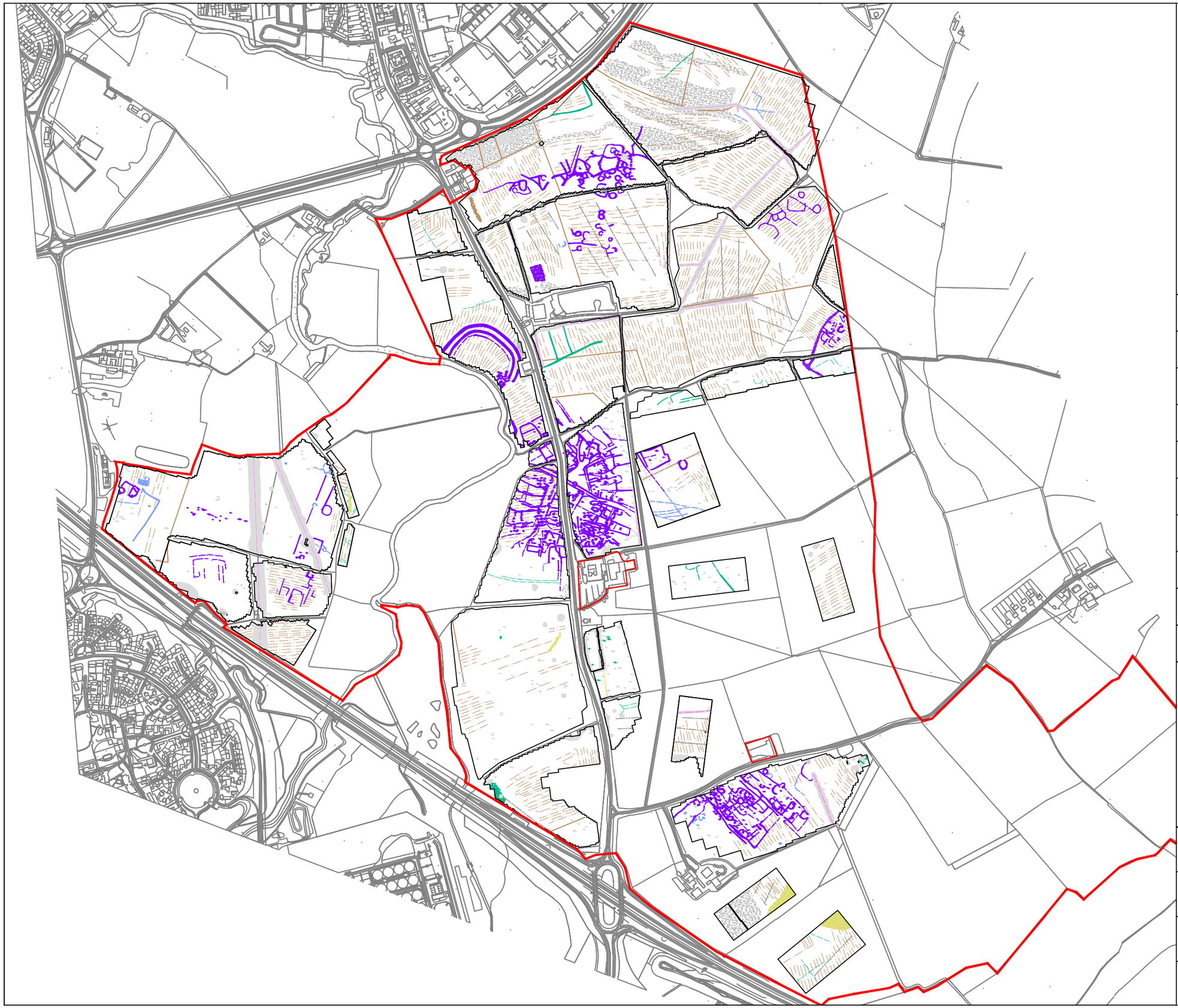
Title:
Magnetometer Survey Greyscale Plots

Client:
RPS Group

Project:
16937 Land East of Milton Keynes, Buckinghamshire

Scale:
0 metres 500
1:10000 @ A3

Fig No:
03



N

KEY

	Probable Archaeology (Discrete / Trend / Negative Response)
	Possible Archaeology (Discrete / Trend / Zone of Increased Response)
	Uncertain (Discrete / Trend / Negative Response)
	Ridge and Furrow
	Former Field Boundary (Corroborated / Conjectural)
	Land Drain
	Natural
	Service Pipe
	Ferrous / Magnetic Disturbance

Title:
Magnetometer Survey Interpretation

Client:
RPS Group

Project:
16937 Land East of Milton Keynes, Buckinghamshire

Scale:
0 metres 500
1:10000 @ A3

Fig No:
04

N

KEY

	Probable Archaeology (Discrete / Trend / Negative Response)
	Possible Archaeology (Discrete / Trend / Zone of Increased Response)
	Uncertain (Discrete / Trend / Negative Response)

Title:
Magnetometer Survey Interpretation (Archaeology)

Client:
RPS Group

Project:
16937 Land East of Milton Keynes, Buckinghamshire

Scale:
0 metres 500
1:10000 @ A3

Fig No:
05

N

KEY

Ridge and Furrow

Title:
Magnetometer Survey Interpretation (Ridge and Furrow)

Client:
RPS Group

Project:
16937 Land East of Milton Keynes, Buckinghamshire

Scale:
0 metres 500
1:10000 @ A3

Fig No:
06

N

2
nT
-1

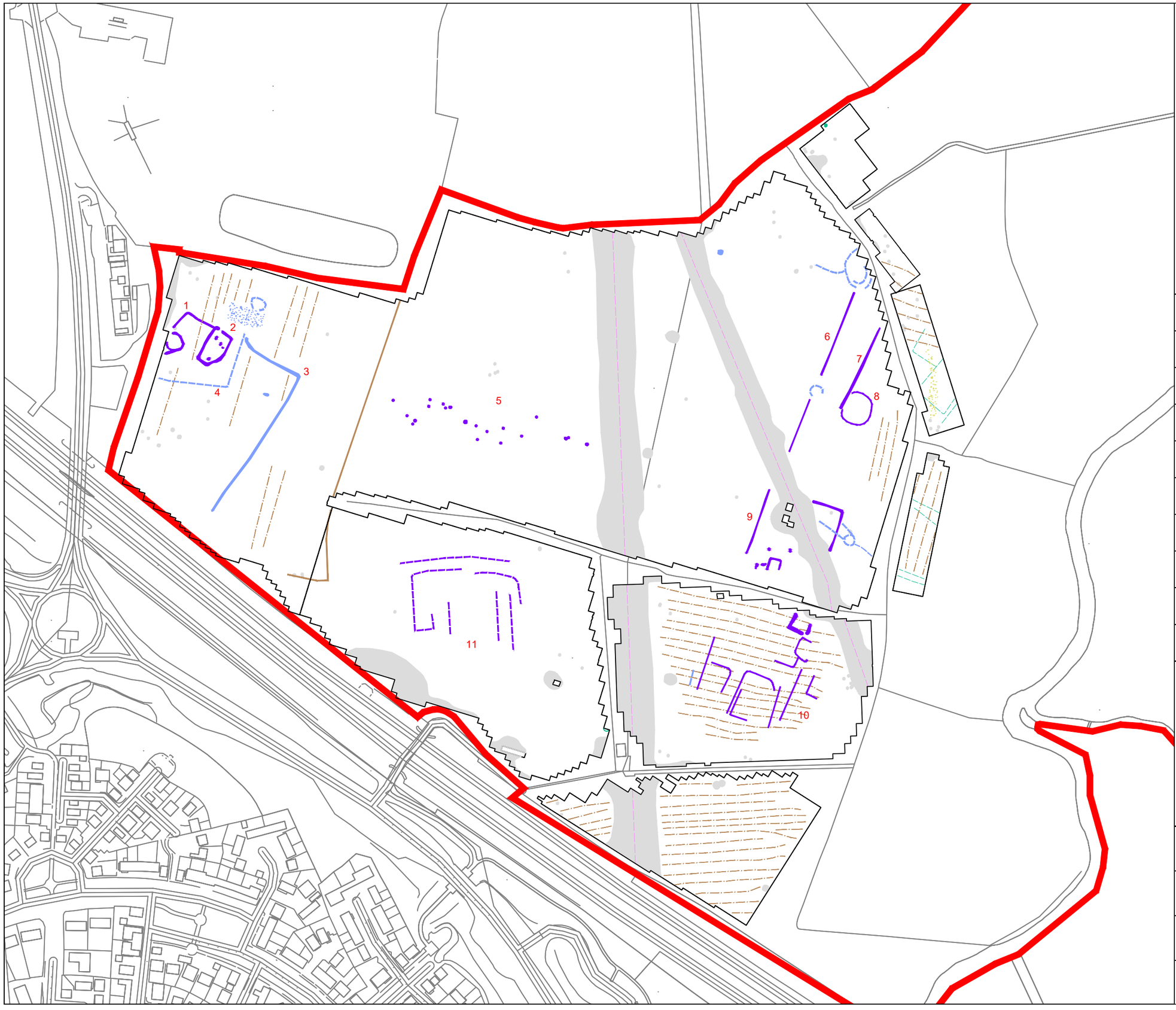
Title:
Magnetometer Survey [Viewport A]
Greyscale Plots

Client:
RPS Group

Project:
16937 Land East of Milton Keynes,
Buckinghamshire

Scale:
0 metres 150
1:3000 @ A3

Fig No:
07



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KEY

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	Possible Archaeology (Discrete / Trend / Zone of Increased Response)
	Uncertain (Discrete / Trend / Negative Response)
	Ridge and Furrow
	Former Field Boundary (Corroborated / Conjectural)
	Land Drain
	Natural
	Service Pipe
	Ferrous / Magnetic Disturbance

Title:
Magnetometer Survey [Viewport A] Interpretation

Client:
RPS Group

Project:
16937 Land East of Milton Keynes, Buckinghamshire

Scale:
0 metres 150
1:3000 @ A3

Fig No:
08

N

2
nT
-1

Title:
Magnetometer Survey [Viewport B]
Greyscale Plots

Client:
RPS Group

Project:
16937 Land East of Milton Keynes,
Buckinghamshire

Scale:
0 metres 225
1:5500 @ A3

Fig No:
09

N

KEY

	Probable Archaeology (Discrete / Trend / Negative Response)
	Possible Archaeology (Discrete / Trend / Zone of Increased Response)
	Uncertain (Discrete / Trend / Negative Response)
	Ridge and Furrow
	Former Field Boundary (Corroborated / Conjectural)
	Land Drain
	Natural
	Service Pipe
	Ferrous / Magnetic Disturbance

Title:
Magnetometer Survey [Viewport B]
Interpretation

Client:
RPS Group

Project:
16937 Land East of Milton Keynes, Buckinghamshire

Scale:
0 metres 225
1:5500 @ A3

Fig No:
10

N

2
nT
-1

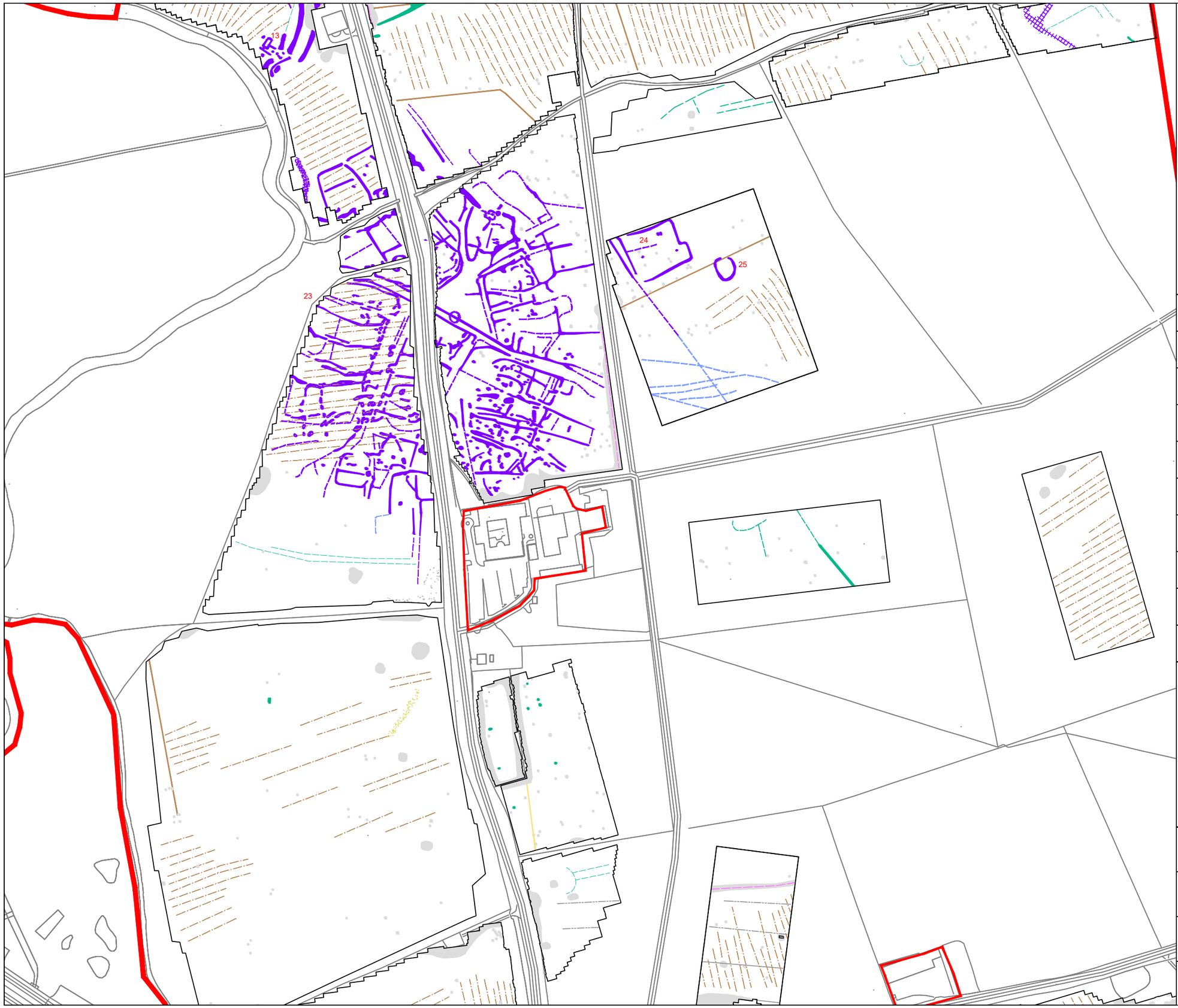
Title:
Magnetometer Survey [Viewport C]
Greyscale Plots

Client:
RPS Group

Project:
16937 Land East of Milton Keynes,
Buckinghamshire

Scale:
0 metres 200
1:4000 @ A3

Fig No:
11



N

KEY

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	Possible Archaeology (Discrete / Trend / Zone of Increased Response)
	Uncertain (Discrete / Trend / Negative Response)
	Ridge and Furrow
	Former Field Boundary (Corroborated / Conjectural)
	Land Drain
	Natural
	Service Pipe
	Ferrous / Magnetic Disturbance

Title:
Magnetometer Survey [Viewport C] Interpretation

Client:
RPS Group

Project:
16937 Land East of Milton Keynes, Buckinghamshire

Scale:
0 metres 225
1:5500 @ A3

Fig No:
12

N

2
nT
-1

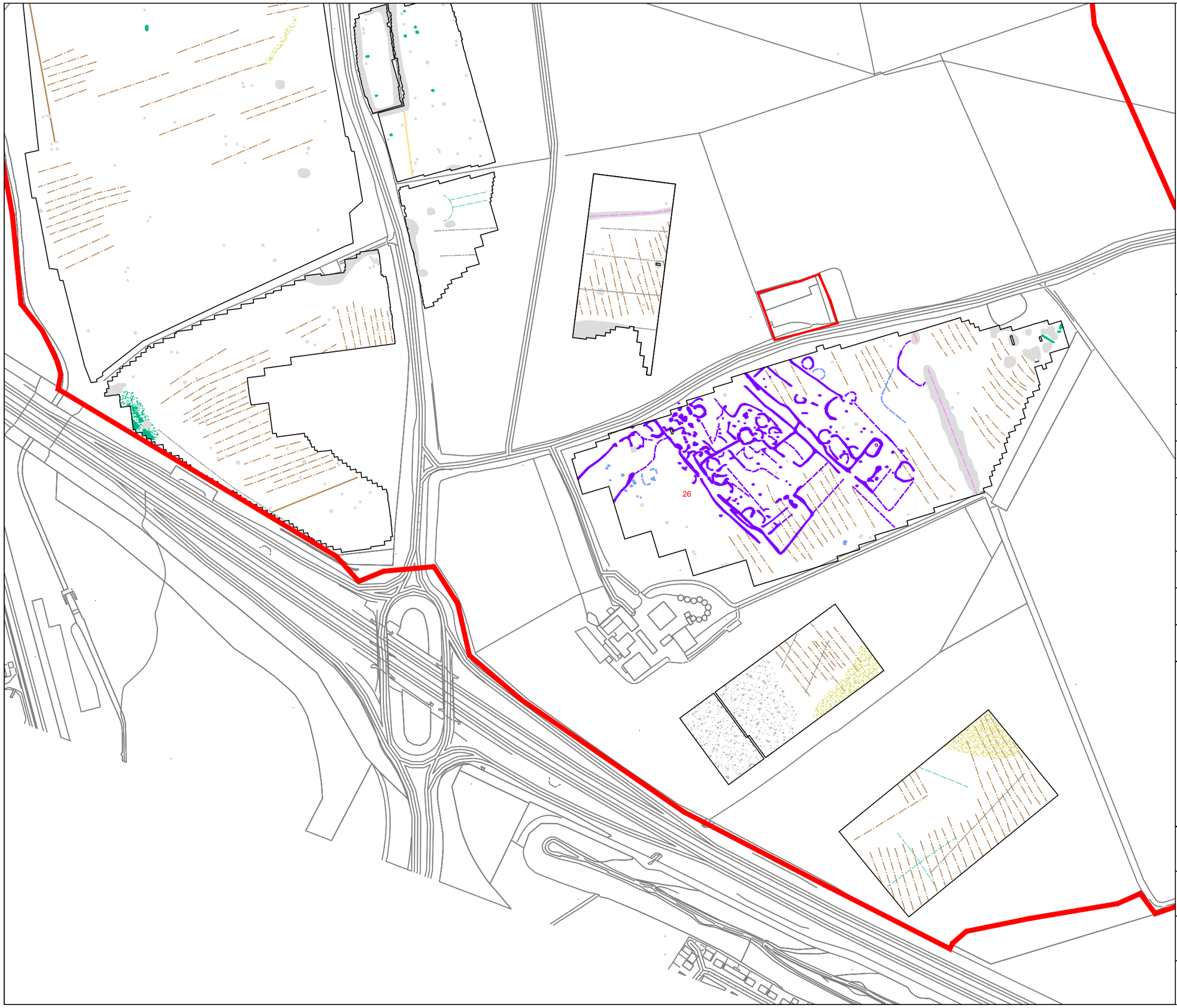
Title:
Magnetometer Survey [Viewport D]
Greyscale Plots

Client:
RPS Group

Project:
16937 Land East of Milton Keynes,
Buckinghamshire

Scale:
0 metres 200
1:4000 @ A3

Fig No:
13



N

KEY

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	Possible Archaeology (Discrete / Trend / Zone of Increased Response)
	Uncertain (Discrete / Trend / Negative Response)
	Ridge and Furrow
	Former Field Boundary (Corroborated / Conjectural)
	Land Drain
	Natural
	Service Pipe
	Ferrous / Magnetic Disturbance

Title:
Magnetometer Survey [Viewport D]
Interpretation

Client:
RPS Group

Project:
16937 Land East of Milton Keynes, Buckinghamshire

Scale:
0 metres 200
1:4000 @ A3

Fig No:
14

N

2
nT
-1

Title:
Magnetometer Survey [Viewport 1]
Greyscale Plots

Client:
RPS Group

Project:
16937 Land East of Milton Keynes,
Buckinghamshire

Scale:
0 metres 100
1:2000 @ A3

Fig No:
15

N

KEY

	Probable Archaeology (Discrete / Trend / Negative Response)
	Possible Archaeology (Discrete / Trend / Zone of Increased Response)
	Uncertain (Discrete / Trend / Negative Response)
	Ridge and Furrow
	Former Field Boundary (Corroborated / Conjectural)
	Land Drain
	Natural
	Service Pipe
	Ferrous / Magnetic Disturbance

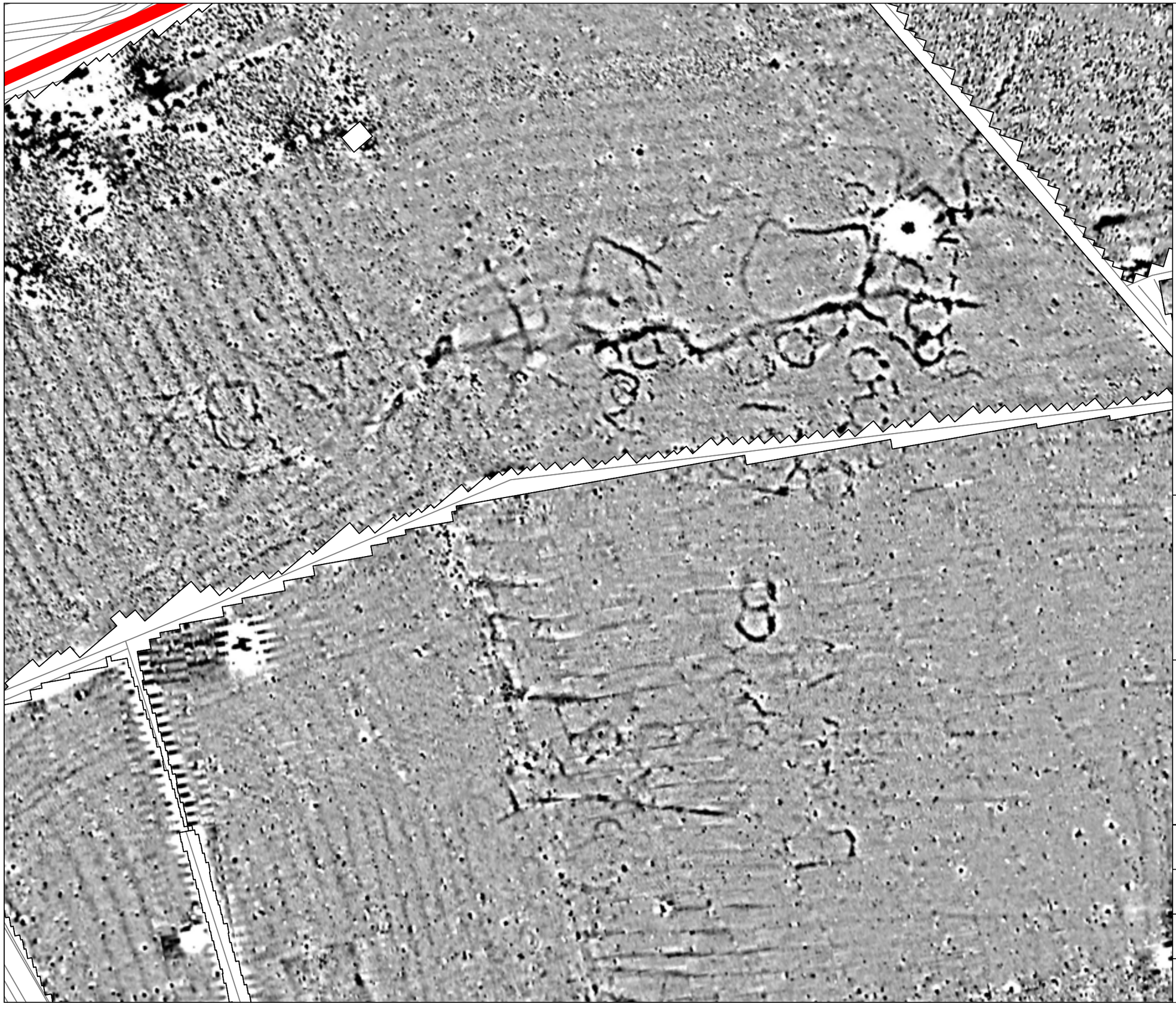
Title:
Magnetometer Survey [Viewport 1]
Interpretation

Client:
RPS Group

Project:
16937 Land East of Milton Keynes, Buckinghamshire

Scale:
0 metres 100
1:2000 @ A3

Fig No:
16



N

2
nT
-1

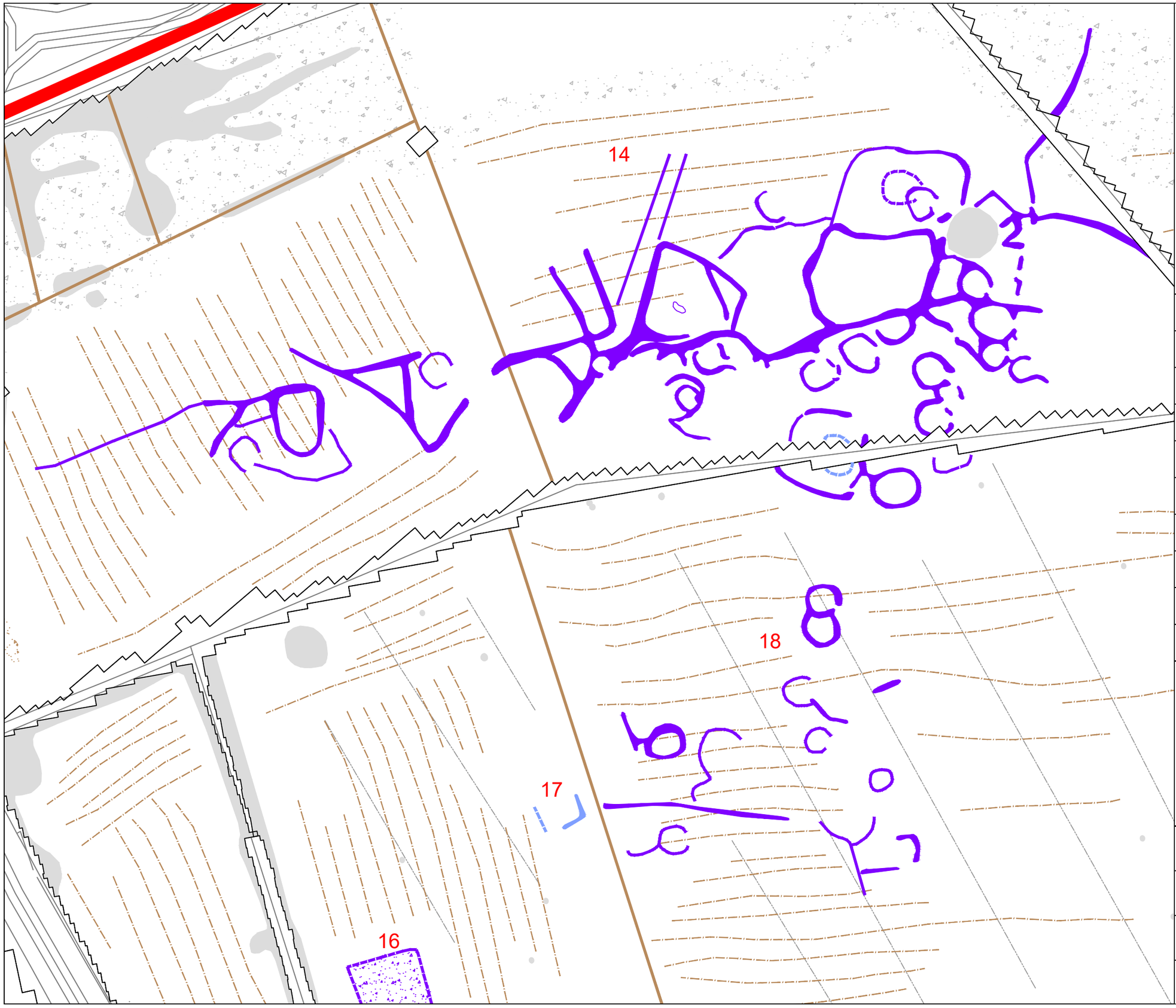
Title:
Magnetometer Survey [Viewport 2]
Greyscale Plots

Client:
RPS Group

Project:
16937 Land East of Milton Keynes,
Buckinghamshire

Scale:
0 metres 75
1:1500 A3

Fig No:
17



N

KEY

	Probable Archaeology (Discrete / Trend / Negative Response)
	Possible Archaeology (Discrete / Trend / Zone of Increased Response)
	Uncertain (Discrete / Trend / Negative Response)
	Ridge and Furrow
	Former Field Boundary (Corroborated / Conjectural)
	Land Drain
	Natural
	Service Pipe
	Ferrous / Magnetic Disturbance

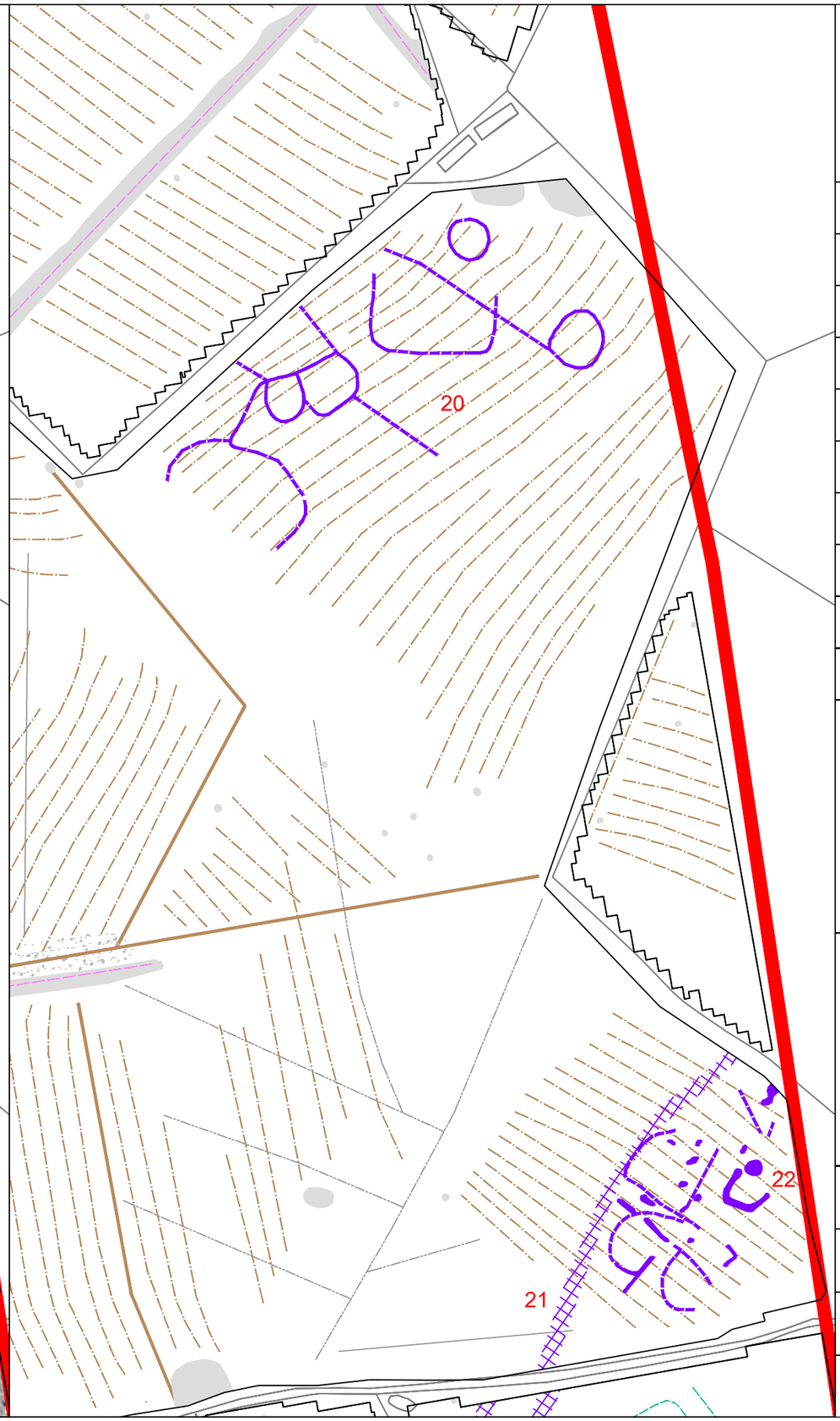
Title:
Magnetometer Survey [Viewport 2]
Interpretation

Client:
RPS Group

Project:
16937 Land East of Milton Keynes, Buckinghamshire

Scale:
0 metres 75
1:1500 @ A3

Fig No:
18



N

KEY

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	Possible Archaeology (Discrete / Trend / Zone of Increased Response)
	Uncertain (Discrete / Trend / Negative Response)
	Ridge and Furrow
	Former Field Boundary (Corroborated / Conjectural)
	Land Drain
	Natural
	Service Pipe
	Ferrous / Magnetic Disturbance

2
nT
-1

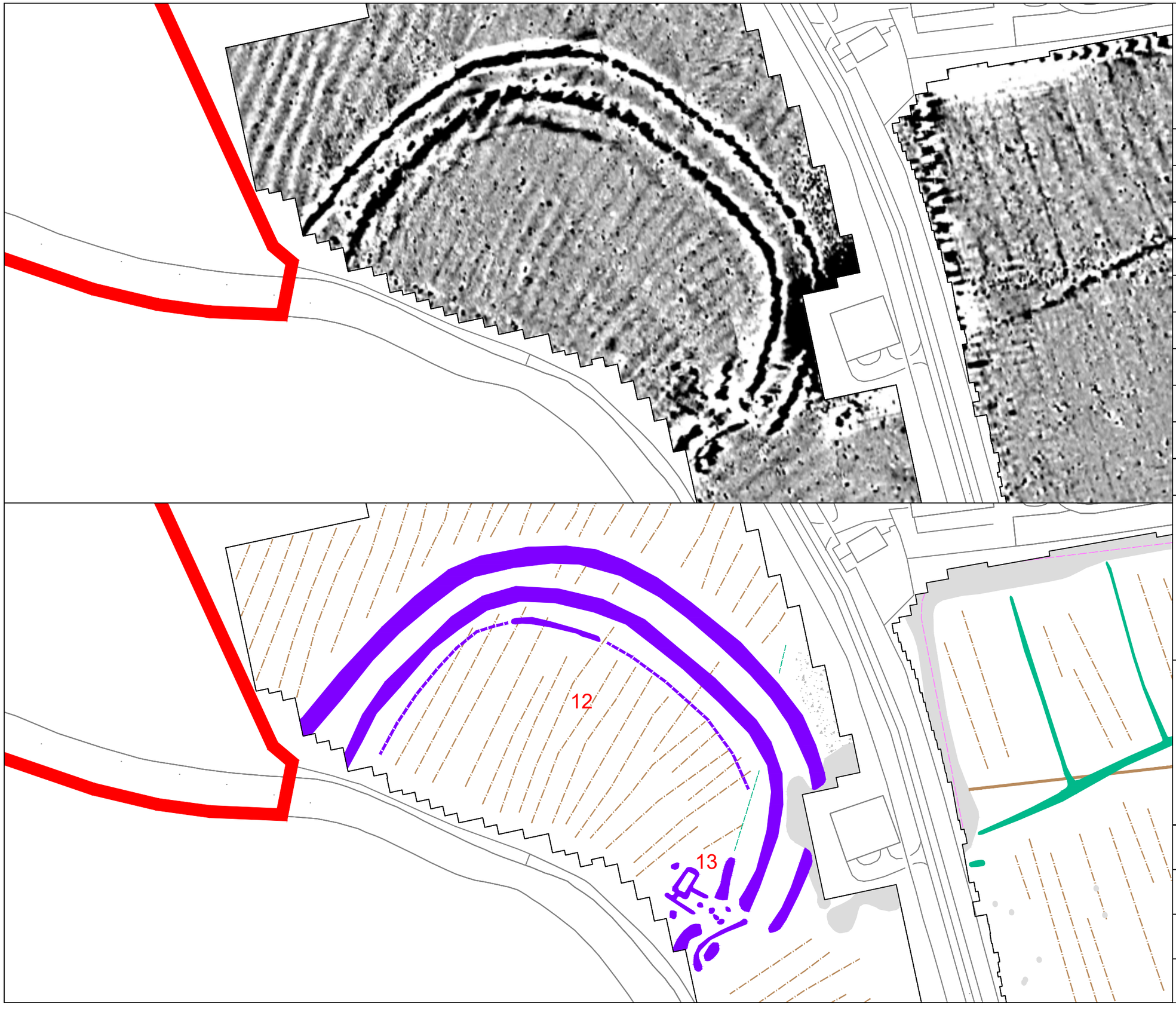
Title:
Magnetometer Survey [Viewport 3]
Greyscale Plots / Interpretation

Client:
RPS Group

Project:
16937 Land East of Milton Keynes, Buckinghamshire

Scale:
0 metres 100
1:2000 A3

Fig No:
19



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KEY

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	Possible Archaeology (Discrete / Trend / Zone of Increased Response)
	Uncertain (Discrete / Trend / Negative Response)
	Ridge and Furrow
	Former Field Boundary (Corroborated / Conjectural)
	Land Drain
	Natural
	Service Pipe
	Ferrous / Magnetic Disturbance

2
nT
-1

Title:
Magnetometer Survey [Viewport 4]
Greyscale Plots / Interpretation

Client:
RPS Group

Project:
16937 Land East of Milton Keynes, Buckinghamshire

Scale:
0 metres 75
1:1500 A3

Fig No:
20

N

2
nT
-1

Title:
Magnetometer Survey [Viewport 5]
Greyscale Plots

Client:
RPS Group

Project:
16937 Land East of Milton Keynes,
Buckinghamshire

Scale:
0 metres 100
1:2000 A3

Fig No:
21

N

KEY

	Probable Archaeology (Discrete / Trend / Negative Response)
	Possible Archaeology (Discrete / Trend / Zone of Increased Response)
	Uncertain (Discrete / Trend / Negative Response)
	Ridge and Furrow
	Former Field Boundary (Corroborated / Conjectural)
	Land Drain
	Natural
	Service Pipe
	Ferrous / Magnetic Disturbance

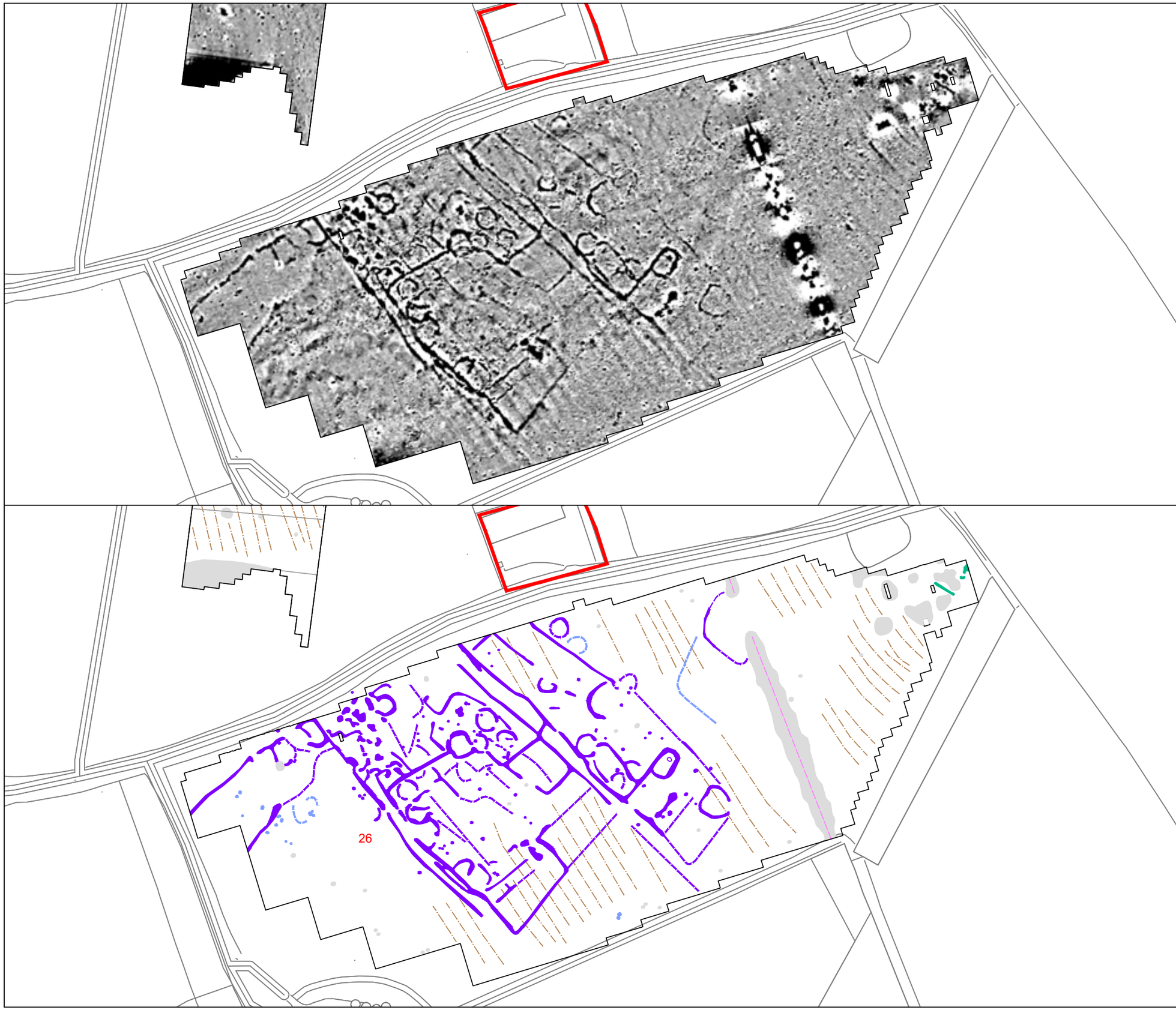
Title:
Magnetometer Survey [Viewport 5]
Interpretation

Client:
RPS Group

Project:
16937 Land East of Milton Keynes, Buckinghamshire

Scale:
0 metres 100
1:2000 A3

Fig No:
22



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KEY

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	Possible Archaeology (Discrete / Trend / Zone of Increased Response)
	Uncertain (Discrete / Trend / Negative Response)
	Ridge and Furrow
	Former Field Boundary (Corroborated / Conjectural)
	Land Drain
	Natural
	Service Pipe
	Ferrous / Magnetic Disturbance

2
nT
-1

Title:
Magnetometer Survey [Viewport 6]
Greyscale Plots / Interpretation

Client:
RPS Group

Project:
16937 Land East of Milton Keynes, Buckinghamshire

Scale:
0 metres 125
1:2500 A3

Fig No:
23

N

10
nT
-10

Title:
Magnetometer Survey [Minimally Processed]
Greyscale Plots

Client:
RPS Group

Project:
16937 Land East of Milton Keynes,
Buckinghamshire

Scale:
0 metres 500
1:10000 @ A3

Fig No:
24

Appendix A - Technical Information: Magnetometer Survey Method, Processing and Presentation

Standards & Guidance

This report and all fieldwork have been conducted in accordance with the latest guidance documents issued by Historic England (EH 2008) (then English Heritage), the Chartered Institute for Archaeologists (ClfA 2014) and the European Archaeological Council (EAC 2016).

Grid Positioning

For hand held gradiometers the location of the survey grids has been plotted together with the referencing information. Grids were set out using a Trimble R8 Real Time Kinematic (RTK) VRS Now GNSS GPS system.

An RTK GPS (Real-time Kinematic Global Positioning System) can locate a point on the ground to a far greater accuracy than a standard GPS unit. A standard GPS suffers from errors created by satellite orbit errors, clock errors and atmospheric interference, resulting in an accuracy of 5m-10m. An RTK system uses a single base station receiver and a number of mobile units. The base station re-broadcasts the phase of the carrier it measured, and the mobile units compare their own phase measurements with those they received from the base station. This results in an accuracy of around 0.01m.

Technique	Instrument	Traverse Interval	Sample Interval
Magnetometer	Bartington Grad 601-2	1m	0.25m

Instrumentation: Bartington *Grad* 601-2

Bartington instruments operate in a gradiometer configuration which comprises fluxgate sensors mounted vertically, set 1.0m apart. The fluxgate gradiometer suppresses any diurnal or regional effects. The instruments are carried, or cart mounted, with the bottom sensor approximately 0.1-0.3m from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is measured in nanoTesla (nT). The sensitivity of the instrument can be adjusted; for most archaeological surveys the most sensitive range (0.1nT) is used. Generally, features up to 1m deep may be detected by this method, though strongly magnetic objects may be visible at greater depths. The Bartington instrument can collect two lines of data per traverse with gradiometer units mounted laterally with a separation of 1.0m. The readings are logged consecutively into the data logger which in turn is daily down-loaded into a portable computer whilst on site. At the end of each site survey, data is transferred to the office for processing and presentation.

Data Processing

Zero Mean Traverse	This process sets the background mean of each traverse within each grid to zero. The operation removes striping effects and edge discontinuities over the whole of the data set.
Step Correction (De-stagger)	When gradiometer data are collected in 'zig-zag' fashion, stepping errors can sometimes arise. These occur because of a slight difference in the speed of walking on the forward and reverse traverses. The result is a staggered effect in the data, which is particularly noticeable on linear anomalies. This process corrects these errors.

Display

Greyscale/ Colourscale Plot	This format divides a given range of readings into a set number of classes. Each class is represented by a specific shade of grey, the intensity increasing with value. All values above the given range are allocated the same shade (maximum intensity); similarly, all values below the given range are represented by the minimum intensity shade. Similar plots can be produced in colour, either using a wide range of colours or by selecting two or three colours to represent positive and negative values. The assigned range (plotting levels) can be adjusted to emphasise different anomalies in the data-set.

Presentation of results and interpretation

The presentation of the results includes a ‘minimally processed data’ and a ‘processed data’ greyscale plot. Magnetic anomalies are identified, interpreted and plotted onto the ‘Interpretation’ drawings.

When interpreting the results, several factors are taken into consideration, including the nature of archaeological features being investigated and the local conditions at the site (geology, pedology, topography etc.). Anomalies are categorised by their potential origin. Where responses can be related to other existing evidence, the anomalies will be given specific categories, such as: Abbey Wall or Roman Road. Where the interpretation is based largely on the geophysical data, levels of confidence are implied, for example: Probable, or Possible Archaeology. The former is used for a confident interpretation, based on anomaly definition and/or other corroborative data such as cropmarks. Poor anomaly definition, a lack of clear patterns to the responses and an absence of other supporting data reduces confidence, hence the classification Possible.

Interpretation Categories

In certain circumstances (usually when there is corroborative evidence from desk-based or excavation data) very specific interpretations can be assigned to magnetic anomalies (for example, *Roman Road, Wall,* etc.) and where appropriate, such interpretations will be applied. The list below outlines the generic categories commonly used in the interpretation of the results.

Archaeology / Probable Archaeology	This term is used when the form, nature and pattern of the responses are clearly or very probably archaeological and /or if corroborative evidence is available. These anomalies, whilst considered anthropogenic, could be of any age.
Possible Archaeology	These anomalies exhibit either weak signal strength and / or poor definition, or form incomplete archaeological patterns, thereby reducing the level of confidence in the interpretation. Although the archaeological interpretation is favoured, they may be the result of variable soil depth, plough damage or even aliasing as a result of data collection orientation.
Industrial / Burnt-Fired	Strong magnetic anomalies that, due to their shape and form or the context in which they are found, suggest the presence of kilns, ovens, corn dryers, metal-working areas or hearths. It should be noted that in many instances modern ferrous material can produce similar magnetic anomalies.
Former Field Boundary (probable & possible)	Anomalies that correspond to former boundaries indicated on historic mapping, or which are clearly a continuation of existing land divisions. Possible denotes less confidence where the anomaly may not be shown on historic mapping but nevertheless the anomaly displays all the characteristics of a field boundary.
Ridge & Furrow	Parallel linear anomalies whose broad spacing suggests ridge and furrow cultivation. In some cases, the response may be the result of more recent agricultural activity.
Agriculture (ploughing)	Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes.
Land Drain	Weakly magnetic linear anomalies, quite often appearing in series forming parallel and herringbone patterns. Smaller drains may lead and empty into larger diameter pipes, which in turn usually lead to local streams and ponds. These are indicative of clay fired land drains.
Natural	These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions.
Magnetic Disturbance	Broad zones of strong dipolar anomalies, commonly found in places where modern ferrous or fired materials (e.g. brick rubble) are present.
Service	Magnetically strong anomalies, usually forming linear features are indicative of ferrous pipes/cables. Sometimes other materials (e.g. pvc) or the fill of the trench can cause weaker magnetic responses which can be identified from their uniform linearity.
Ferrous	This type of response is associated with ferrous material and may result from small items in the topsoil, larger buried objects such as pipes, or above ground features such as fence lines or pylons. Ferrous responses are usually regarded as modern. Individual burnt stones, fired bricks or igneous rocks can produce responses similar to ferrous material.
Uncertain Origin	Anomalies which stand out from the background magnetic variation, yet whose form and lack of patterning gives little clue as to their origin. Often the characteristics and distribution of the responses straddle the categories of *Possible Archaeology* / *Natural* or (in the case of linear responses) *Possible Archaeology* / *Agriculture*; occasionally they are simply of an unusual form.

Where appropriate some anomalies will be further classified according to their form (positive or negative) and relative strength and coherence (trend: weak and poorly defined).

Appendix B - Technical Information: Magnetic Theory

Detailed magnetic survey can be used to effectively define areas of past human activity by mapping spatial variation and contrast in the magnetic properties of soil, subsoil and bedrock. Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.1 nanoTeslas (nT) in an overall field strength of 48,000 (nT), can be accurately detected.

Weakly magnetic iron minerals are always present within the soil and areas of enhancement relate to increases in *magnetic susceptibility* and permanently magnetised *thermoremanent* material.

Magnetic susceptibility relates to the induced magnetism of a material when in the presence of a magnetic field. This magnetism can be considered as effectively permanent as it exists within the Earth's magnetic field. Magnetic susceptibility can become enhanced due to burning and complex biological or fermentation processes.

Thermoremanence is a permanent magnetism acquired by iron minerals that, after heating to a specific temperature known as the Curie Point, are effectively demagnetised followed by re-magnetisation by the Earth's magnetic field on cooling. Thermoremanent archaeological features can include hearths and kilns; material such as brick and tile may be magnetised through the same process.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement allowing assessment and characterisation of subsurface features. Material such as subsoil and non-magnetic bedrock used to create former earthworks and walls may be mapped as areas of lower enhancement compared to surrounding soils.

Magnetic survey is carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field whilst the lower sensor measures the same field but is also more affected by any localised buried feature. The difference between the two sensors will relate to the strength of a magnetic field created by this feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity and disturbance from modern services.

Appendix 2

Land East of Milton Keynes Geophysical Survey Phase 2 May 2020

GEOPHYSICAL SURVEY

Land east of Milton Keynes, Buckinghamshire

25141
May 2020
HER Event No: EMK1418

rpsgroup.com

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1. Introduction

1.1. Magnitude Surveys Ltd (MS) was commissioned by RPS to undertake a geophysical survey on a c.103.5ha area of land east of Milton Keynes, Buckinghamshire (SP 89612 41488).

1.2. The geophysical survey comprised hand-carried, GNSS-positioned fluxgate gradiometer survey.

1.3. The survey was conducted in line with the current best practice guidelines produced by Historic England (David et al., 2008), the Chartered Institute for Archaeologists (CIfA, 2014) and the European Archaeological Council (Schmidt et al., 2015).

1.4. It was conducted in line with a WSI produced by MS (Magnitude Surveys, 2020).

1.5. The survey commenced on 20/04/2020 and took 11 days to complete.

2. Quality Assurance

2.1. Magnitude Surveys is a Registered Organisation of the Chartered Institute for Archaeologists (CIfA), the chartered UK body for archaeologists, and a corporate member of ISAP (International Society of Archaeological Prospection).

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

3. Objectives

3.1. The objective of this geophysical survey was to assess the subsurface archaeological potential of the survey area.

4. Geographic Background

4.1. The survey area was located c.7km northeast of Milton Keynes, Buckinghamshire (Figure 1). Survey was undertaken across sixteen arable fields. The survey area was bounded by fields to the north and east, the A509 to the west and the M1 to the south (Figure 2). Within the survey boundary, an area of c. 3.3ha was not surveyable, this was due to the presence of a construction site, unsurveyable ground conditions and some field access falling within COVID-19 restriction zones.

4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	Arable field, gently sloping down from west to east.	Bounded to the north by hedgerows, a tractor track and hedgerow to the south, and hedgerows to the west. The field continued beyond the survey area to the east.
2	Arable field, sloping down from southeast to northwest.	Bounded to the northeast and southwest by hedgerows, hedgerows and a farm track to the southeast and the field continued beyond the survey area to the northwest.
3	Arable field, sloping slightly in the northern half of the field downwards from south to north. Small unsurveyable area in the southwest corner due to farming waste.	Bounded to the east and west by hedgerows, and by a tractor track and hedgerow to the south. The field continued beyond the survey area to the north.
4	Flat, arable field.	Bounded to the north and west by hedgerows, and the field continued beyond the survey area to the east and southeast.
5	Arable field, sloping slightly downwards from north to south.	Bounded on all sides by hedgerows except for a small gap on the north-eastern corner, where the field continued beyond the survey area.
6	Arable field, sloping down from east to west.	Bounded to the north, east and south by hedgerows and to the west by a farm track.
7	Arable field, sloping down from east to west.	Bounded on all sides by hedgerows except for a small gap on the north-eastern corner, where the field continued beyond the survey area.
8	Flat, arable field.	Bounded to the north, east and south by hedgerows, the field continued beyond the survey area to the west
9	Flat, arable field.	Bounded to the north by hedgerows, east by a farm track, west by a construction site, southwest by hedgerows. The field continued beyond the survey area to the northwest.
10	Flat, arable field. Small unsurveyable area in the northwest corner due to a construction area.	Bounded to the north, east and south by hedgerows and a farm track to the west. There was a construction site in the south-western corner.
11	Flat, arable field.	Bounded to the north, south and west by hedgerows, the field continued beyond the

		survey area to the east. There was a short strip of hedgerows in the middle of the two fields. In the south-western corner were farm buildings.
12	Flat, arable field.	Bounded on all sides by hedgerows.
13	Flat, arable field. Small unsurveyable area in the northwest of the field due to farming waste.	Bounded to the northeast by hedgerows, a tractor track to the southwest, and trees to the northwest. The field continued beyond the survey area to the southeast.
14	Arable field slightly sloping down from east to west	Bounded to the northeast by trees, and to the east, south and west by hedgerows. The field continued beyond the survey area to the northwest.
15	Flat, arable field.	Bounded to the northeast by hedgerows and trees, to the northwest and south by a wooden fence and construction site on the hard shoulder of the M1 to the west.
16	Flat, arable field.	Bounded to the northeast by hedgerows, to the east and south by hedgerows and trees and to the west by a fence and horse paddocks. The field continued beyond the survey area to the northwest.

4.3. The underlying geology comprises mudstone of Peterborough Member across the majority of the survey area, and mudstone of the Stewartby Member in the centre-east (Areas 5, 11 & 12). Superficial deposits are recorded in the north-eastern areas as diamicton of the Oadby Member (Areas 1 - 7 & 11), aside from deposits of sand and gravel of Glaciofluvial Deposits in Area 12, no further superficial deposits are recorded across the remaining survey area (British Geological Survey, 2020).

4.4. The soils across the majority of the survey area consist of lime-rich loamy and clayey soils with impeded drainage. In Areas 8 and 9 the soils consist of slightly acid, loamy and clayey soils, also with impeded drainage (Soilscapes, 2020).

5. Archaeological Background

5.1. The following is a summary of a DBA produced by CgMs, now RPS (CgMs 2018) and the results of a previous Geophysical Survey produced by SUMO, for RPS (SUMO 2020).

5.2. Multiphase archaeological activity has been identified within the survey area during previous geophysical investigation. In a north-western field of the survey area, a rectilinear enclosure was partially identified along with two linear anomalies that appear to continue from the west, where series of anomalies indicate a possible multiphase settlement site dating from Iron Age and Romano-British through to Saxon and into the Medieval period.

5.3. The previous geophysical investigation in the central part of the survey area, identified a series of rectilinear enclosures, trackways, ring ditches, pits and ditches indicate a settlement, of presumed prehistoric date with possible multiphase activity.

5.4. Prehistoric activity has been identified in the wider environs to the north of the survey area. In the northwest a possible curvilinear cropmark enclosure has been recorded and interpreted as

a possible Viking encampment (MMK3823). Previous geophysical investigation in this area identified a series of ditches and associated banks which form a fortified enclosure utilising the river as the southern defences. Further evidence of prehistoric activity from the previous survey is present directly north of the survey area, as a series of ring ditches, enclosures and a probable trackway. Extending over 400m from east to west the complex appears to be a small prehistoric settlement although the site is not currently recorded in the HER.

5.5. Evidence of Bronze Age activity is present in the wider environs to the west of the survey area, identified as cropmark evidence for possible Bronze Age ring ditches and barrow cemeteries (HER: MMK502, MMK504, MMK929-30 & NMR: 345028). Geophysical survey undertaken identified a ring ditch, which appeared to correspond with a Bronze Age barrow identified in local records (HER: MMK 929 & NMR: 1588616).

5.6. Roman activity in the area was discovered during archaeological evaluation undertaken along the route of the M1 which identified Iron Age and Roman ditches, pits and other evidence of occupation (NMR Ref: 1324853). Further evidence of Roman activity is present in the possible line of a Roman Road beyond the survey area to the west (NMR: 868140).

5.7. Possible Romano-British activity has been identified to the immediate west of the survey area on the opposite side of the A509. Identified through geophysical investigation the data appears to show a series of trackways and enclosures in a rectilinear pattern. Further irregular enclosures with curvilinear boundaries indicate multiperiod use with a later Medieval date.

5.8. Medieval activity has been identified in the wider environs in the form of ridge and furrow cultivation to the west of the survey area (NMR: 915523) and multiple systems were identified during the previous geophysical survey.

6. Methodology

6.1. Data Collection

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

6.1.2. Table of survey strategies:

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

6.1.3. The magnetic data were collected using MS' bespoke hand-carried, GNSS-positioned system.

6.1.3.1. MS' hand-carried system was comprised of Bartington Instruments Grad 13 Digital Three-Axis Gradiometers. Positional referencing was through a multi-channel, multi-constellation GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The RTK GPS is accurate to 0.008m + 1ppm in the horizontal and 0.015m + 1ppm in the vertical.

6.1.3.2. Magnetic and GPS data were stored on an SD card within MS' bespoke datalogger. The datalogger was continuously synced, via an in-field Wi-Fi unit, to servers within MS' offices. This allowed for data collection, processing and visualisation to be monitored in real-time as fieldwork was ongoing.

6.1.3.3. A navigation system was integrated with the RTK GPS, which was used to guide the surveyor. Data were collected by traversing the survey area along the longest possible lines, ensuring efficient collection and processing.

6.2. Data Processing

6.2.1. Magnetic data were processed in bespoke in-house software produced by MS. Processing steps conform to Historic England's standards for "raw or minimally processed data" (see sect 4.2 in David et al., 2008: 11).

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

Zero Median Traverse – The median of each sensor traverse is calculated within a specified range and subtracted from the collected data. This removes striping effects caused by small variations in sensor electronics.

Projection to a Regular Grid – Data collected using RTK GPS positioning requires a uniform grid projection to visualise data. Data are rotated to best fit an orthogonal grid projection and are resampled onto the grid using an inverse distance-weighting algorithm.

Interpolation to Square Pixels – Data are interpolated using a bicubic algorithm to increase the pixel density between sensor traverses. This produces images with square pixels for ease of visualisation.

6.3. Data Visualisation and Interpretation

6.3.1. This report presents the gradient of the sensors' total field data as greyscale images, as well as the total field data from the lower sensors. The gradient of the sensors minimises external interferences and reduces the blown-out responses from ferrous and other high contrast material. However, the contrast of weak or ephemeral anomalies can be reduced through the process of calculating the gradient. Consequently, some features can be clearer in the respective gradient or total field datasets. Multiple greyscale images at different plotting ranges have been used for data interpretation. Greyscale images should be viewed alongside the XY trace plot (Figures 12, 16, 19, 22, 25, 28, 31, 34, 37 & 40). XY trace plots visualise the magnitude and form of the geophysical response, aiding in anomaly interpretation.

6.3.2. Geophysical results have been interpreted using greyscale images and XY traces in a layered environment, overlaid against open street maps, satellite imagery, historic maps, LiDAR data, and soil and geology maps. Google Earth (2020) was consulted as well, to compare the results with recent land usages.

6.3.3. Geodetic position of results - All vector and raster data have been projected into OSGB36 (ESPG27700) and can be provided upon request in ESRI Shapefile (.SHP) and

Geotiff (.TIF) respectively. Figures are provided with raster and vector data projected against OS Open Data.

7. Results

7.1. Qualification

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

7.2. Discussion

7.2.1. The geophysical results are presented in consideration with historic and satellite mapping (Figures 6 and 10).

7.2.2. The fluxgate gradiometer survey has responded well to the environment of the survey area. The geophysical survey has detected a range of anomalies comprising archaeological, agricultural and possible extraction activity. The underlying mudstone geology has produced a relatively quiet magnetic background. Anomalies relating to natural infill deposits have been recorded in the south, where there is an absence of recorded superficial geology (Section 4.3). Modern activity comprises magnetic disturbance along field boundaries and possibly related to remains of former fence posts, several services which cross the survey area, as well as a small concentration of dipolar anomalies in the south related to an infilled pond.

7.2.3. Two centres of archaeological settlement activity have been identified within the survey area. One to the northwest (Figure 5) consists of a large rectilinear enclosure with internal delimitations and a possible overlaying smaller enclosure, suggesting a multiphase activity (Figure 15). A previous geophysical investigation (Section 5) has identified a multiphase settlement immediately to the west, beyond the scope of this survey, as well as part of the detected enclosure itself, with a previously postulated occupation period of Romano-British to Medieval. The magnetic signal and location of the detected anomalies suggest that this is a likely eastern extension from the main settlement, the lack of further anomalies to the north and east within the survey area and their generally weak magnetic signal also suggest that the enclosure is situated at the edge of the settlement area. Additional linear anomalies with characteristics of ditch features have been identified leading to the southeast of the enclosure, in the form of a possible land division potentially extending activity south-eastwards.

Although some “returns” have been identified, the extended ditches appear to mainly form a land division extending southeast and are visible running to the centre of the survey area (Figures 5, 15, 18 & 21).

7.2.4. The second foci of archaeological activity has been identified in the centre of the survey area (Figures 24 & 27). These anomalies differ in magnetic signal and morphology from the enclosure and ditch anomalies detected to the north and though a possible land division extends in its direction, no clear evidence of relationship could be identified between both centres of activity. Approximately 25 rectilinear enclosures and ring ditches were identified with dimensions characteristic of small rectilinear structures and potential roundhouses. Though the dimensions of the ring ditches are potentially indicative of either barrows or roundhouses, the presence of openings in the more clearly detected features is more characteristic of a domestic structure. The layout appears to be that of a prehistoric open settlement, potentially Iron Age to Romano-British in origin, and likely predating the anomalies detected to the north. The anomalies have been identified following the edge of a ridge in the topography, forming a linear band of habitation, which extends northeast from the settlement site identified during the previous geophysical survey immediately to the south of the area (Section 5). Additional linear ditches have also been identified in this area, potentially forming larger enclosures or land divisions, which extend away from the main axis to the southeast, and some to the northwest. To the west they overlap some of the ring ditches indicating multiple phases of activity (Figure 27). An extant farm building, a service and a former field boundary identified on historic mapping cross the settlement (Figures 6 & 27), which has disturbed and masked some of the archaeological activity; however, a clear relationship between the anomaly to the east and to the west of the farm buildings can be established.

7.2.5. Agricultural activity has mainly been identified in the form ridge and furrow cultivation across the entire survey area, detected in multiple alignments (Figures 6 & 10). For the majority, the extents of the ploughing regimes respect one another however in the south some overlapping is visible, which is characteristic of a prolonged agricultural usage. Two former field boundaries were also identified, both crossing anomalies of archaeological origin in the north and the centre of the survey area. The impact of the former field boundaries on the archaeological activity is higher in the centre (Figure 24), resulting in a probable spread of material both of agricultural and archaeological origin. Intensive drainage has been identified in the south, but almost no drainage features were detected in the north, possibly due to the change in superficial geology and topography (Section 4.3). More recent agricultural activity has been identified in the form of modern ploughing and the possible remnants of fence post bases, forming a boundary not recorded on available historic maps or satellite imagery.

7.2.6. Two zones have been identified in the south with a possible relation to extraction and infilling activity. The smaller zone in the southeast has a magnetic signal suggesting extraction (Figure 39), while the larger one in the southwest has a magnetic signal characteristic of infilling (Figure 36). The presence of a former gravel pit c.270 m west

of the survey area with similar dimensions indicates that the likely extraction-related anomaly could be an unrecorded, infilled gravel pit (Figure 10).

7.2.7. Undetermined anomalies were identified as discrete potential burnt-fired or pit features, or as linear features of no clear origin.

Interpretation

7.2.8. General Statements

7.2.8.1. Geophysical anomalies will be discussed broadly as classification types across the survey area. Only anomalies that are distinctive or unusual will be discussed individually.

7.2.8.2. **Magnetic Disturbance** – The strong anomalies produced by extant metallic structures along the edges of the field have been classified as 'Magnetic Disturbance'. These magnetic 'haloes' will obscure the response of any weaker underlying features, should they be present, often over a greater footprint than the structure they are being caused by.

7.2.8.3. **Ferrous (Spike)** – Discrete ferrous-like, dipolar anomalies are likely to be the result of isolated modern metallic debris on or near the ground surface.

7.2.8.4. **Ferrous/Debris (Spread)** – A ferrous/debris spread refers to a concentrated deposition of discrete, dipolar ferrous anomalies and other highly magnetic material.

7.2.8.5. **Undetermined** – Anomalies are classified as Undetermined when the anomaly origin is ambiguous through the geophysical results and there is no supporting or correlative evidence to warrant a more certain classification. These anomalies are likely to be the result of geological, pedological or agricultural processes, although an archaeological origin cannot be entirely ruled out. Undetermined anomalies are generally not ferrous in nature.

7.2.9. Magnetic Results - Specific Anomalies

7.2.9.1. **Archaeology Probable (Strong/ Weak)** – In the northwest of Area 3, several weak and strong positive linear anomalies with continuous magnetic signals characteristic of ditch anomalies have been identified forming a large enclosure (c. 90 x c. 65m) (Figure 15). A linear anomaly [**3a**] running in an east-west orientation internally divides the large enclosure in two approximately equal parts. Discrete anomalies indicative of pits have been identified in both halves; however, the southern half appears more complex with an additional smaller enclosure c.25 x 25m [**3b**] detected. The western extent of the large enclosure is demarked by a double ditch feature; however, the northwest corner appears to extend beyond the bounds of the survey area making interpretation more ambiguous. It is not clear whether the double ditch feature is representative of a trackway along the western edge of the enclosure, or a ditch-feature more closely related to enclosure [**3b**] which abuts the anomaly. C.40m south of the large enclosure several weakly positive, fragmented linear anomalies have been

identified continuing to the south [**3c, 6a & 7a**] across Areas 3, 6 and 7 (Figures 15 & 21). Several return features at 90degree angles and small branches are extending from the linear anomaly, however no clear enclosures can be identified. The singular nature of this anomaly is suggestive of a land division rather than a trackway, which leads southeast away from the enclosure complex towards less anthropogenically active areas.

7.2.9.2. **Archaeology Possible (Strong/Weak)** – In the east of Area 5 several weakly positive, disjointed linear anomalies [**5a**] have been identified (Figure 18). They do not form a clear pattern and could not be identified more confidently, however their magnetic signal is similar to the anomalies of probable archaeological origin nearby (c. 108m to the east) and they may share the same origin.

7.2.9.3. **Archaeology Probable (Strong/Weak)** – Strong positive linear and curvilinear anomalies have been identified in Areas 10 and 11 (Figures 24 & 27). This concentration of ring ditches and small rectangular enclosures are situated on a northeast to southwest aligned ridge, one of the high points in the local topography. Approximately 25 partial and complete enclosures have been identified (some weaker/partial ones were difficult to accurately account for). Most of the detected enclosures were of circular shape with diameters ranging between c.10m and c.13m, several of which also appear to have openings, indicating that these were more likely roundhouses rather than barrows, which can also fall within these dimensions. This band of dense archaeological activity extends both sides of extant farm buildings located in the south-western corner of Area 11 (Figure 27). The anomalies appear to extend northeast from where a previous survey detected a multiphase prehistoric settlement (SUMO 2020), located outside of the survey area, to the south of the **10a**. Additional strong linear ditches have been detected along the settlement [**10a & 11a**]. In the west [**10a**] appear to overlap round ditches suggesting a multiphase settlement. The overall layout of the enclosures as well as the intermixing of circular and rectilinear enclosures are suggestive of a possible late prehistoric open settlement, potentially of Iron Age to Romano-British origin. The linear anomaly [**11a**] measures c.100m in length It has been fragmented by subsequent ridge and furrow cultivation; despite this perpendicular return anomalies can be identified which appear to enclose the small enclosures.

7.2.9.4. **Archaeology Probable/Possible (Strong/Weak/Zone) –** Anomalies with weakly positive magnetic signals forming similar circular and rectilinear enclosures have also been detected continuing southeast from the main northeast-southwest axis [**10a & 11a**] (and to a lesser extent northwest). However, it is not clear whether the magnetic signal of these anomalies is weaker due to less intense anthropogenic activity on the slope of the ridge, or whether colluvial processes on the slope has lessened the preservation of these anomalies. Two areas of probable and possible archaeological "Zones" have been identified close to areas which have been disturbed by modern or historic activity. These

zones represent areas where anomalies are obscured by magnetic disturbance, or debris, where it is likely archaeological features continue but are somewhat masked. Finally, a strong positive anomaly [**11b**] has been detected immediately south of the north-eastern end of the detected archaeological anomalies. Although **11b** likely relates to the concentration of anomalies c. 20m to the north, its magnetic signal is similar to that of a very large pit (c. 9m in diameter), whether it is of natural or archaeological origin is unclear.

7.2.9.5. **Ridge and Furrow** – Regularly spaced, parallel, linear and curvilinear anomalies have been detected in every field within the survey area (Figures 4 & 6). The spacing (c. 6m – c. 9.4m) and largely curvilinear form are characteristic of ridge and furrow cultivation. These are strongly enhanced in Areas 5 and 13, likely due to variations in the geological deposits (Section 4.3). Multiple alignments have been identified, with variations on either roughly east to west, tending northwards in the east, or north-northwest to south-southeast. Areas 1, 2, 3, 10, 13 & 14 contain multiple orientations of cultivation that do not respect boundaries identified on available historic mapping. This suggests that there may be unmapped former field boundaries where the orientations change.

7.2.9.6. **Agricultural** – Crossing northeast to southwest across Areas 2 and 3 in the north of the survey area (Figures 12 & 15), and approximately east-west across Area 13 in the south (Figure 33), weak linear anomalies have been detected. These align with former field boundaries identified on 2nd edition OS maps (Figures 6 & 10). Further south in Area 11 (Figure 24) a concentration of dipolar anomalies was also detected following the location of a former field boundary (Figure 6). As this boundary appears to cross the southern "centre" of archaeological activity, there may be a cross-over of anomalies relating to both the former field boundary and the archaeology. Modern ploughing was identified in the form of parallel linear trends, across the full extent of the survey area.

7.2.9.7. **Possible Extraction** – A large discrete anomaly with a strong, positively enhanced magnetic signal along its southern edge has been identified in the south-eastern corner of Area 14 (Figure 39). Its magnetic signal, being positive surrounded by a negative halo, is typical of extraction pits. A former gravel pit has been identified on historic maps c. 270m west of Area 15, suggesting that the anomaly could similarly relate to a former gravel pit (Figure 10).

7.2.9.8. **Ferrous/Debris (Spread)** - Two concentrations of multiple small dipolar anomalies Have been detected within Areas 15 and 16, this type of magnetic signal is indicative of a deposition of material (Figure 36). Located at the border between Areas 15 and 16 a small patch of debris has been identified which corresponds with the location of a former pond on historic maps (Figure 10). Its magnetic signal is characteristic of a pond back-filled with a mixed material containing some magnetic properties. A larger and more concentrated area of dipolar anomalies, c. 0.37ha in size, has been detected in the southwest of Area 16 (Figure 32). While these anomalies do not correspond with any features

recorded on available historic maps, the presence of a former gravel pit c.270m east (Figure 10) with similar dimensions may suggest a possible origin.

7.2.9.9. **Natural** – Anomalies identified as natural in origin have mainly be identified in the south where the topography and the absence of recorded superficial geology have produced enough magnetic contrast to create good conditions for natural infill to be detected. These anomalies are interpreted as being the product of finer grained material that is more magnetically enhanced, accumulating in cracks and fissures.

7.2.9.10. **Undetermined** – Multiple anomalies of undetermined origin were identified within the survey area. The linear and curvilinear anomalies may relate to either anthropogenic activity or natural processes, their orientations and isolated locations have limited further interpretation. A number of discrete anomalies have been identified which exhibit unusual dipolar magnetic signals, which could indicate burning activity or a pit feature, of unknown date. Equally, dipolar signals are most commonly associated with ferrous-type anomalies, however, the undetermined anomalies identified have an unusual inverse of the typical ferrous-type signal.

8. Conclusions

8.1. A fluxgate gradiometer survey has successfully been undertaken across the survey area. The geophysical survey has detected a range of different types of anomalies of archaeological, agricultural, natural, and modern origin. The underlying mudstone geology and superficial deposits have contributed to the relatively quiet magnetic data. Modern activity in the form of broad ferrous anomalies have been recorded along field boundaries, several underground services, potential former fence posts, and anomalies likely relating to an infilled pond. Possible extraction activity has been identified in the south-eastern corner of the survey area.

8.2. Two foci of archaeological activity have been identified within the survey area, one in the northwest and a second in the centre of the survey area. There is no clear relationship between the two identified settlement sites. Both appear to be continuations of archaeological activity previously identified during an earlier geophysical survey within and outside of this survey's extent. The north-western rectilinear enclosures extend eastwards from the survey boundary, with a potential land division leading away to the southeast. The likely earlier settlement located in the centre of the survey area appears Iron Age to Romano-British in form, following an open settlement layout which aligns with the edge of a ridge. This settlement consists of a series of approximately 25 identifiable ring ditches and rectilinear enclosures, potentially representing roundhouses, rectangular structures and enclosures.

8.3. Agricultural activity has been detected in the form of extensive ridge and furrow cultivation activity across the whole survey area, with anomalies relating to three former field boundaries also identified from historic mapping. Drainage networks were detected in the south of the survey area and modern ploughing was detected across the survey area.

9. Archiving

9.1. MS maintains an in-house digital archive, which is based on Schmidt and Ernenwein (2013). This stores the collected measurements, minimally processed data, georeferenced and un-georeferenced images, XY traces and a copy of the final report.

9.2. MS contributes reports to the ADS Grey Literature Library upon permission from the client, subject to the any dictated time embargoes.

10. Copyright

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11. References

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12. Project Metadata

MS Job Code	MSSP655
Project Name	Land East of Milton Keynes, Buckinghamshire
Client	RPS
Grid Reference	SP 89612 41488
Survey Techniques	Magnetometry
Survey Size (ha)	103.5ha (Magnetometry)
Survey Dates	2020-20-04 to 2020-01-05
Project Manager	Finnegan Pope-Carter BSc (Hons) MSc FGS
Project Officer	Leanne Swinbank, BA ACIfA
HER Event No	N/A
OASIS No	N/A
S42 Licence No	N/A
Report Version	0.2

13. Document History

Version	Comments	Author	Checked By	Date
0.1	Initial draft for Project Officer to Review	JC, LB, LG	LS	11 May 2020
0.2	Review for Project Manager. Report issued to client.	LB	FPC	12 May 2020

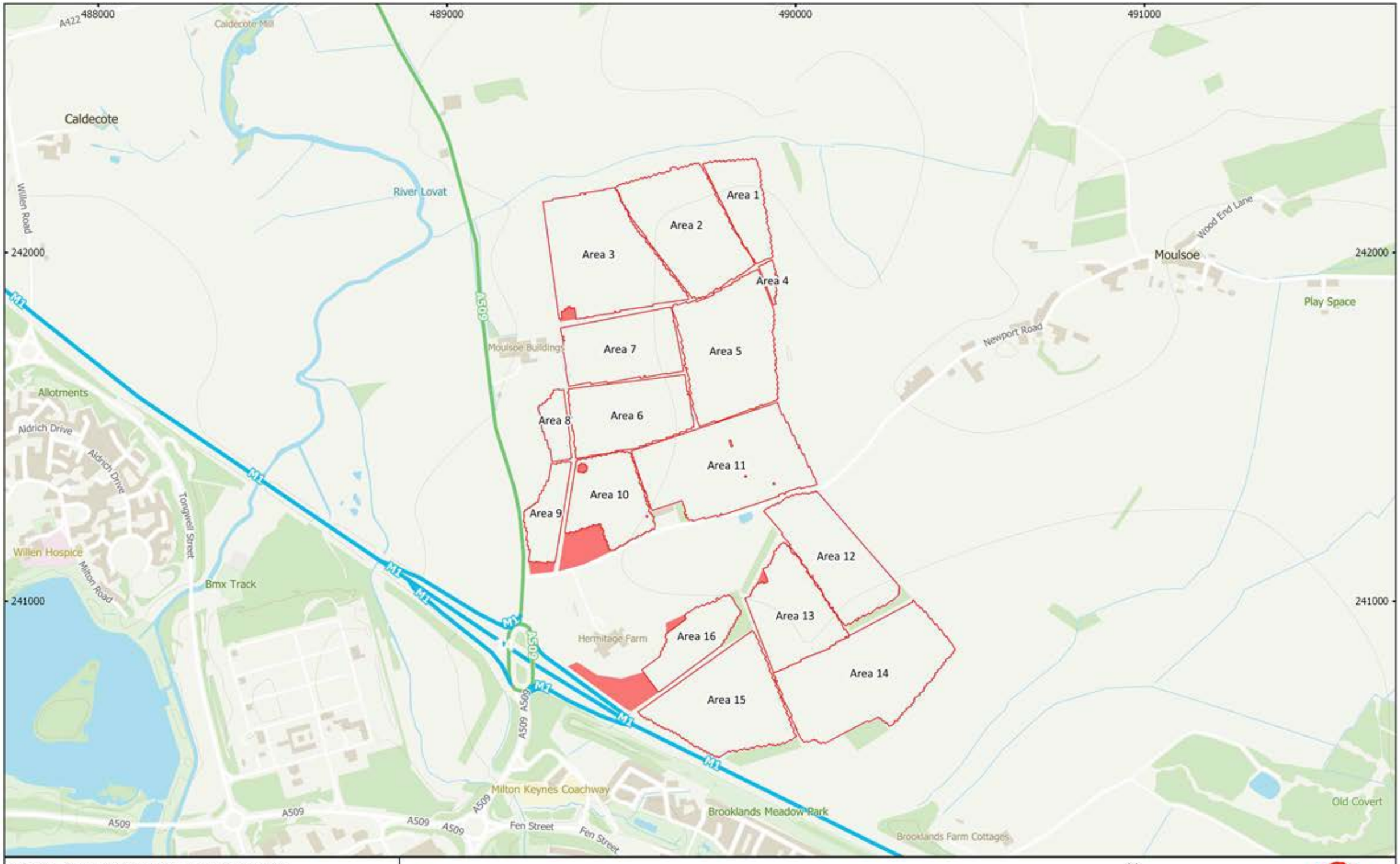
MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 1 - Site Location
1:25,000 @ A4

Site Boundary

N

0 0.5 1 km

magnitude surveys



MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 2 - Location of Survey Areas
1:10,000 @ A3

Survey Extent
Unsurveyable Areas

N

0 200 400 600 m

magnitude surveys

489000
489500
490000
242000
241600
River Lovat
A509
Moulsoe Buildings
Newport Road
Area 1
Area 2
Area 3
Area 4
Area 5
Area 7
Area 8
Area 9
Area 11

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 3 - Magnetic Total Field (Lower Sensor) (Overview) (North)
1:4,000 @ A3

48,997 nT 49,005

N

0 100 200 300 m

magnitude surveys

489000
489500
490000
River Lovat
A509
242000
242000
Area 1
Area 2
Area 3
Area 4
Area 5
Area 7
Moulsoe Buildings
Area 8
Area 9
Area 11
Newport Road
241600
241600

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 4 - Magnetic Gradient (Overview) (North)
1:4,000 @ A3

-1 nT 2

A509

N

0 100 200 300 m

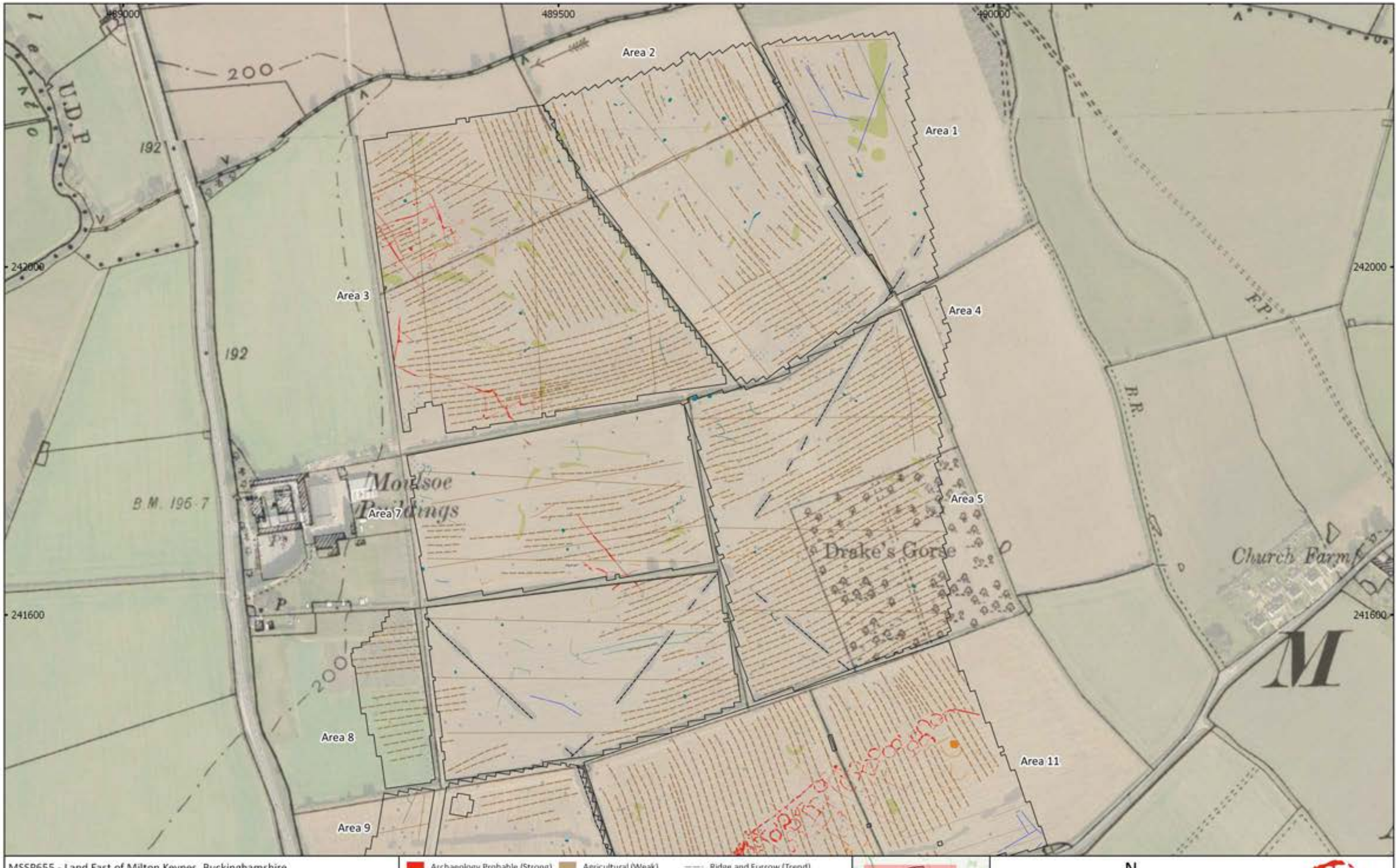
magnitude surveys

489000
489500
490000
242000
241600
River Lovat
A509
Moulsoe Buildings
Newport Road
Area 1
Area 2
Area 3
Area 4
Area 5
Area 7
Area 8
Area 9
Area 11

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 5 - Magnetic Interpretation (Overview) (North)
1:4,000 @ A3

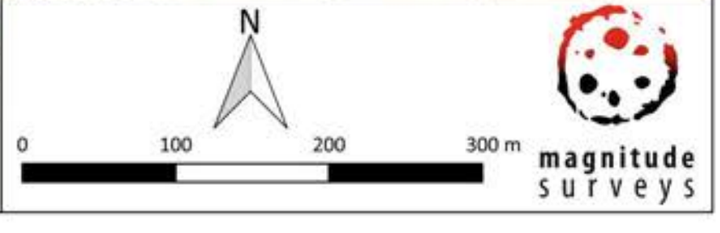
- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Probable (Zone)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Archaeology Possible (Zone)
- Agricultural (Strong)
- Agricultural (Weak)
- Natural (Strong)
- Natural (Weak)
- Magnetic Disturbance
- Ferrous/Debris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

N
0 100 200 300 m
magnitude surveys



MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 6 - Magnetic Interpretation Over Historic and Satellite Maps (Overview) (North)
1:4,000 @ A3

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



magnitude surveys

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 7 - Magnetic Total Field (Lower Sensor) (Overview) (South)
1:4,000 @ A3

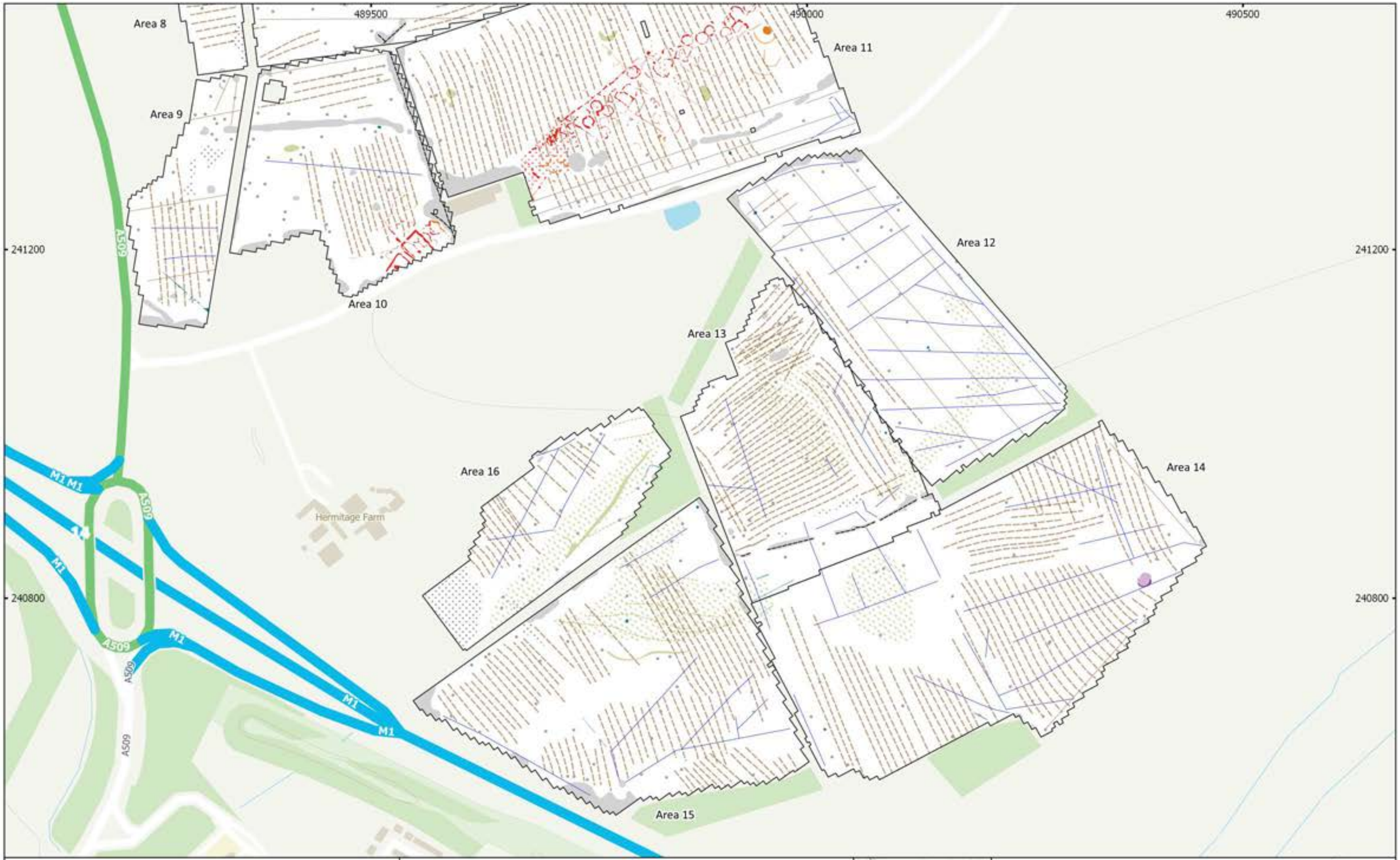
48,997 nT 49,005

N

0 100 200 300 m

magnitude surveys

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 8 - Magnetic Gradient (Overview) (South)
1:4,000 @ A3



MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 9 - Magnetic Interpretation (Overview) (South)
1:4,000 @ A3

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

N

0 100 200 300 m

magnitude surveys

Area 8
489500
490000
490500
Area 11
Area 9
206
Acres
241200
241200
Area 12
Area 10
Area 13
G.P
M.P
Pagnell 2
64
Area 16
F.P.
Area 14
F
Cottage Farm
208
240800
240800
Old
Gravel Pit
200
200
Area 15

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 10 - Magnetic Interpretation Over Historic and Satellite Maps (Overview) (South)
1:4,000 @ A3

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

N
0 100 200 300 m

magnitude surveys

489600
489800
490000
242250
242100
241950
Area 1
Area 2
Area 4
MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 11 - Magnetic Gradient (Areas 1, 2 & 4)
1:1,500 @ A3

-1 nT 2
A509
0 30 60 90 m
N
magnitude surveys

489600
489800
490000
242250
242100
241950
Area 1
Area 2
Area 4
MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 12 - Magnetic Interpretation (Areas 1, 2 & 4)
1:1,500 @ A3

Agricultural (Strong)
Agricultural (Weak)
Natural (Weak)
Magnetic Disturbance
Ferrous/Debris (Spread)
Undetermined (Strong)
Undetermined (Weak)
Ridge and Furrow (Trend)
Agricultural (Trend)
Natural (Trend)
Drainage Feature
Service
Ferrous (Spike)
A509
N
0
30
60
90 m
magnitude surveys

489600
489800
490000
242250
242100
241950
Area 1
Area 2
Area 4

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 13 - XY Trace Plot (Areas 1, 2 & 4)
30nT/cm at 1:1,500 @ A3

N

0 30 60 90 m

magnitude surveys

489200

489400

489600

242100

242100

Area 3

241950

241950

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 14 - Magnetic Gradient (Areas 2 & 3)
1:1,500 @ A3

-1 nT 2

A509

N

0 30 60 90 m

magnitude surveys

489200
489400
489600
242100
241950
3a
3b
3c
Area 3

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 15 - Magnetic Interpretation (Areas 2 & 3)
1:1,500 @ A3

- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Agricultural (Strong)
- Agricultural (Weak)
- Natural (Weak)
- Magnetic Disturbance
- Ferrous/Debris (Spread)
- Undetermined (Strong)
- Undetermined (Weak)
- Ridge and Furrow (Trend)
- Agricultural (Trend)
- Natural (Trend)
- Ferrous (Spike)

A509

N

0 30 60 90 m

magnitude surveys

489200
489400
489600
242100
241950
Area 3
MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 16 - XY Trace Plot (Areas 2 & 3)
30nT/cm at 1:1,500 @ A3

A509
N
0
30
60
90 m
magnitude surveys

489600
489800
490000
Area 4
241800
Area 5
241650
MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 17 - Magnetic Gradient (Area 5)
1:1,500 @ A3

-1
nT
2
A509
N
0
30
60
90 m
magnitude surveys

489600
489800
490000
Area 4
241800
241800
Area 5
7a
5a
241650
241650
6a

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 18 - Magnetic Interpretation (Area 5)
1:1,500 @ A3

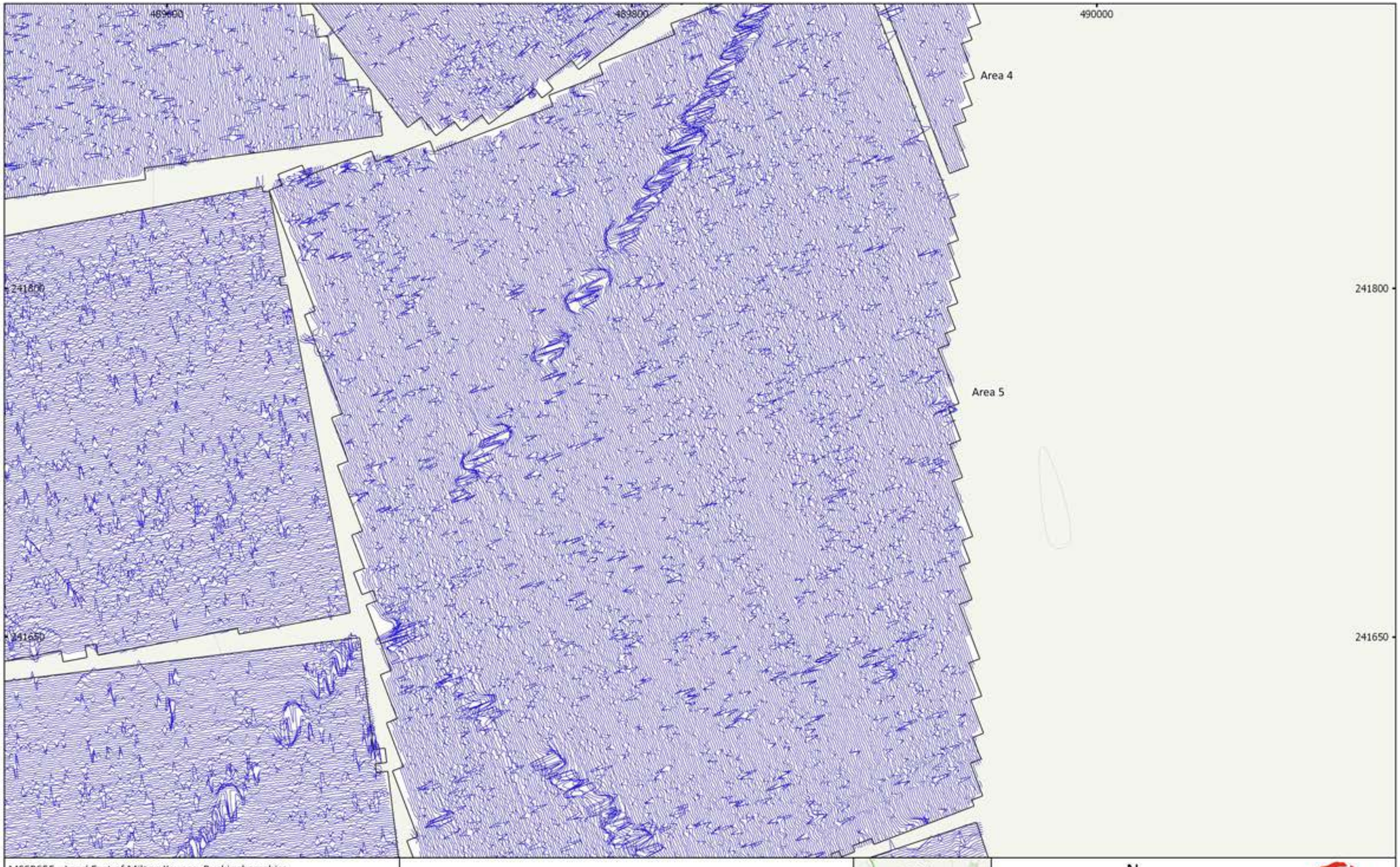
- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Natural (Strong)
- Natural (Weak)
- Magnetic Disturbance
- Ferrous/Debris (Spread)
- Undetermined (Strong)
- Undetermined (Weak)
- Ridge and Furrow (Trend)
- Agricultural (Trend)
- Natural (Trend)
- Service
- Ferrous (Spike)

A509

N

0 30 60 90 m

magnitude surveys



MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 19 - XY Trace Plot (Area 5)
30nT/cm at 1:1,500 @ A3

N

0 30 60 90 m

magnitude surveys

489200
489400
241800
241650
241500
Moulsoe Buildings
Area 7
Area 6
Area 8
A509
MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 20 - Magnetic Gradient (Areas 6, 7 & 8)
1:1,500 @ A3

-1 nT 2
0 30 60 90 m
N
magnitude surveys

489200
489400
489600
241800
241650
241500
Moulsoe Buildings
Area 7
Area 6
Area 8
7a
6a
A509
MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 21 - Magnetic Interpretation (Areas 6, 7 & 8)
1:1,500 @ A3

Archaeology Probable (Strong)
Archaeology Probable (Weak)
Archaeology Possible (Strong)
Archaeology Possible (Weak)
Natural (Strong)
Natural (Weak)
Magnetic Disturbance
Ferrous/Debris (Spread)
Undetermined (Strong)
Undetermined (Weak)
Ridge and Furrow (Trend)
Agricultural (Trend)
Natural (Trend)
Drainage Feature
Service
Ferrous (Spike)
N
0
30
60
90 m
magnitude surveys

489200
489400
489600
241800
241650
241500
Mousoe Buildings
Area 7
Area 6
Area 8
A509
MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 22 - XY Trace Plot (Areas 6, 7 & 8)
30nT/cm at 1:1,500 @ A3

N
0
30
60
90 m
magnitude surveys

489600
489800
490000
241500
241350
Area 11
Area 12
MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 23 - Magnetic Gradient (Area 11)
1:1,500 @ A3

-1 nT 2
A509
N
0 30 60 90 m
magnitude surveys

489600
489800
490000
241500
241500
241350
241350
11a
11b
Area 11
Area 12

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 24 - Magnetic Interpretation (Area 11)
1:1,500 @ A3

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

N
0 30 60 90 m

magnitude surveys

489600
489800
490000
241500
241350
Area 11
Area 12
N
0
30
60
90 m
magnitude surveys

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 25 - XY Trace Plot (Area 11)
30nT/cm at 1:1,500 @ A3

489400
489680
489980
241350
241200
Area 8
Area 9
Area 10
Area 11
A509
MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 26 - Magnetic Gradient (Areas 9 & 10)
1:1,500 @ A3

-1 nT 2
N
0 30 60 90 m
magnitude surveys

489400

489600

489800

241350

241200

Area 8

Area 9

Area 10

Area 11

11a

10a

A509

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 27 - Magnetic Interpretation (Areas 9 & 10)
1:1,500 @ A3

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

N

0 30 60 90 m

magnitude surveys

489400
489600
489800
241350
241200
Area 8
Area 9
Area 10
Area 11
A509

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 28 - XY Trace Plot (Areas 9 & 10)
30nT/cm at 1:1,500 @ A3

N
0 30 60 90 m

magnitude surveys

490000
490200
490
241200
241200
241050
241050
Area 12
Area 13
Area 14
Area 15
MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 29 - Magnetic Gradient (Areas 12 & 13)
1:1,500 @ A3

-1
nT
2
A509
N
0
30
60
90 m
magnitude
surveys

490000
490200
490
241200
241200
241050
241050
Area 12
Area 13
Area 14
Area 15

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 30 - Magnetic Interpretation (Areas 12 & 13)
1:1,500 @ A3

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

N
0
30
60
90 m

magnitude surveys

490000
490200
490
241200
241200
Area 12
241050
Area 13
241050
Area 14
Area 15
MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 31 - XY Trace Plot (Areas 12 & 13)
30nT/cm at 1:1,500 @ A3

A509
N
0
30
60
90 m
magnitude surveys

489600
489800
490000
241050
241050
Area 13
Area 15
240900
240900
Area 16
240750
240750

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 32 - Magnetic Gradient (Areas 13 & 16)
1:1,500 @ A3

-1 nT 2

A509

N

0 30 60 90 m

magnitude surveys

489600
489800
490000
241050
241050
Area 13
Area 15
240900
240900
Area 16
240750
240750

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 33 - Magnetic Interpretation (Areas 13 & 16)
1:1,500 @ A3

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

A509

N

0 30 60 90 m

magnitude surveys

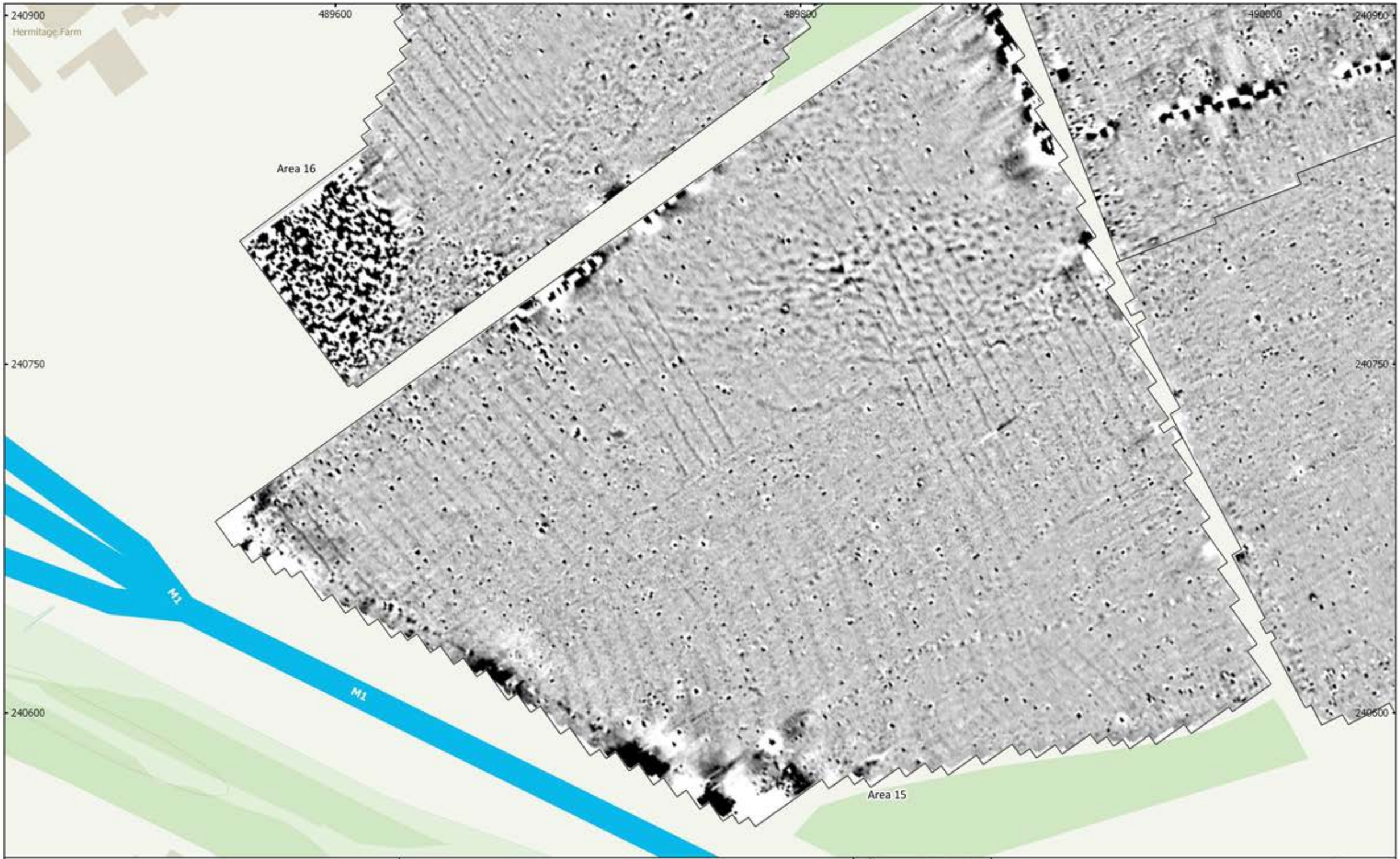
489600
489800
490000
241050
241050
Area 13
Area 15
240900
240900
Area 16
240750
240750

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 34 - XY Trace Plot (Areas 13 & 16)
30nT/cm at 1:1,500 @ A3

N

0 30 60 90 m

magnitude surveys



MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 35 - Magnetic Gradient (Area 15)
1:1,500 @ A3

-1 nT 2

N

0 30 60 90 m

magnitude surveys

240900
489600
489800
490000
240900
Hermitage Farm
Area 16
240750
240750
M1
M1
240600
240600
Area 15

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 36 - Magnetic Interpretation (Area 15)
1:1,500 @ A3

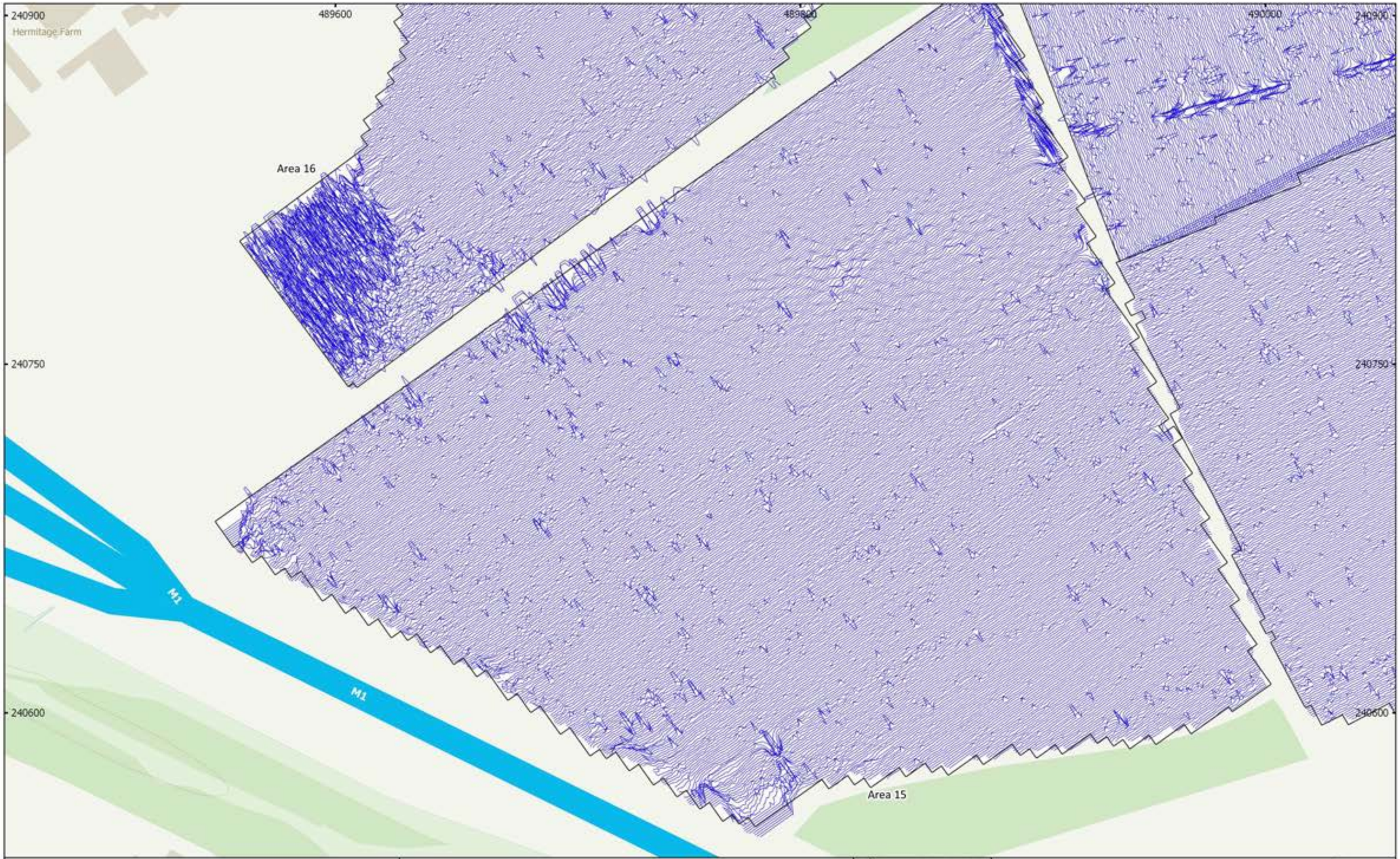
Agricultural (Weak)
Natural (Weak)
Natural (Zone)
Magnetic Disturbance
Ferrous/Debris (Spread)
Undetermined (Strong)
Undetermined (Weak)
Ridge and Furrow (Trend)
Natural (Trend)
Drainage Feature
Service
Ferrous (Spike)

A509
M1

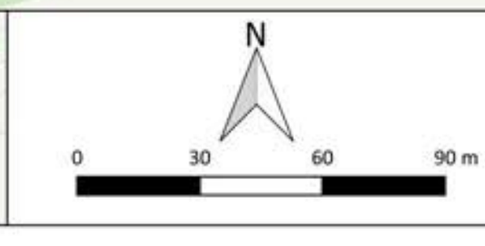
N

0 30 60 90 m

magnitude surveys



MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 37 - XY Trace Plot (Area 15)
30nT/cm at 1:1,500 @ A3



magnitude surveys

490000
490200
490400
240900
240750
240600
Area 14
MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 38 - Magnetic Gradient (Area 14)
1:1,500 @ A3

-1
nT
2
N
0
30
60
90 m
magnitude surveys

490000
490200
490400
240900
240750
240600
Area 14

MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 39 - Magnetic Interpretation (Area 14)
1:1,500 @ A3

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

N
0
30
60
90 m

magnitude surveys

490000
490200
490400
240900
240750
240600
Area 14
N
0
30
60
90 m
MSSP655 - Land East of Milton Keynes, Buckinghamshire
Figure 40 - XY Trace Plot (Area 14)
30nT/cm at 1:1,500 @ A3

magnitude surveys

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