TIGERGEO

Land off Union Road, Stowmarket, Suffolk

Geophysical Survey Report
(Caesium Vapour Magnetic - Archaeology)

Project code: USS161

HER Event: ESF23743

HER Parish Code: ONS 007

OASIS: tigergeo1-246308

Produced for:

CgMs Consulting

Authors:

MJ Roseveare, Senior Geophysicist

BSc(Hons) MSc MEAGE FGS MCIfA

K Armstrong, Lead Geophysicist (Archaeology)

BA(Hons) MSc PhD

13th April 2016

Environmental Geophysics – Survey, Research and Consultancy

TIGERGEO

Land off Union Road, Stowmarket, Suffolk

Digital data

Item	Sent to	Sent date
CAD – Vector Elements	Myk Flitcroft	13/04/16

Audit

Version	Author	Checked	Date
Interim			
Draft Final	MJ Roseveare, K Armstrong	ACK Roseveare	13/04/16
Final			
Revision			
OASIS Form Completion			

Project metadata

Project Name	Land off Union Road, Stowmarket, Suffolk
Project Code	USS161
Client	CgMs Consulting
Fieldwork Dates	30-31/03/2016
Field Personnel	K Cunningham, J Wild
Data Processing Personnel	K Armstrong, ACK Roseveare
Reporting Personnel	MJ Roseveare, K Armstrong, D Lewis
Draft Report Date	13/04/16
Final Report Date	TBC

TigerGeo Limited

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Registered Office: 2 Wyevale Business Park, Kings Acre, Hereford, Herefordshire HR4 7BS UK

+44 (0) 1989 730 564 – www.tigergeo.com - @TigerGeoUK – also on LinkedIn & Facebook

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Non-Technical Summary

A magnetic survey was commissioned by CgMs Consulting to prospect land off Union Road, Stowmarket, Suffolk for buried structures of archaeological interest. The survey was undertaken using a towed array of caesium vapour magnetometers.

The survey has identified a palimpsest of previously known and unknown linear landscape divisions representing former field systems and boundaries. Some of these are ambiguous in character and are likely to relate to the existing copse of trees on the western border of the site but they could also pre-date this and relate to a slight rise in the ground at this location.

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1 Introduction

Land off Union Road, Stowmarket, Suffolk was magnetically surveyed to prospect for buried structures of archaeological interest.

14.1 ha of the original footprint was suitable for survey and completed, over an emerging crop. A strip along the southern site boundary could not be completed as it is not currently in cultivation and had rough ground conditions and tall vegetation that was not safe to survey.

Country	England
County	Suffolk
Nearest Settlement	Stowmarket
Central Co-ordinates	603205, 258926

2 Context

2.1 Background information

The following is extracted *verbatim* from the Specification for Geophysical Survey submitted to, and approved by, Suffolk County Council (TigerGeo, 2016).

"Quoted from the Brief (SCCAS, 2016):

"This allocation lies in an area of archaeological importance recorded in the County Historic Environment Record. A field walking survey detected a number of prehistoric, Roman and medieval finds (ONS 007 and SKT 009) and archaeological investigations at the northern end of Chilton Leys have uncovered extensive occupation remains of prehistoric, Roman and Saxon date, including pottery kilns and a Saxon cemetery (HGH 052). The development site is also located in an area which is topographically favourable for early occupation, overlooking the Rattlesden River and on a south facing slope. As a result, this location has good potential for the discovery of important hitherto unknown archaeological sites and features in view of its proximity to known remains.

From a brief inspection of records accessible through Heritage Gateway, there seems to be a range of prehistoric activity from palaeolithic times onwards. Flint tools of various eras have been found, also a cropmark of a 25m ring ditch (1582859, possible Bronze Age round barrow) noted from aerial photography in the adjacent field to the west.

A few Roman coin findspots are located close to if not within the survey area. Medieval findspots are scattered through the general area and the workhouse to the north (which became known as Stow Union Workhouse) was built in the 1780s.

Old OS maps show previous field boundaries subdividing the existing two fields: a north-south boundary, the line of which is preserved as a footpath, and a boundary separating the northwestern part of the area. A small pond near the western boundary disappears from mapping between 1927 and 1969. At the eastern end of the surviving internal boundary there appears to have been a pond accessible to both northern and southern fields which doesn't appear on modern aerial photographs and may have effectively been subsumed into the field boundaries. The line of an additional footpath crossing the northern field appears to follow the parish boundary.

The fieldwalking carried out in 2009 (Archaeological Solutions, 2009) documented struck flint, burnt flint, Roman-era ceramic building material, as well as late medieval and later pottery."

2.2 Environment

Soilscapes Classification	8: Lime-rich loamy and clayey soils with impeded drainage (S, majority) 9: slightly acid loamy and clayey soils with impeded drainage (N)
Superficial 1:50000 BGS	Lowestoft Formation – Diamicton (LOFT)
Bedrock 1:50000 BGS	Crag Group – Sand (CRAG)
Topography	Moderate slope down to S, N of site is close to local high point
Hydrology	Impeded surface drainage, presumed agricultural land drains
Current Land Use	Agricultural - arable
Historic Land Use	Agricultural - mixed
Vegetation Cover	Emerging crop
Sources of Interference	Traffic on adjacent roads, fencing and housing, electricity poles in north field

The soils may be naturally weakly magnetic, and soil-filled features cut into underlying deposits will likely produce detectable magnetic anomalies although overall contrast may be moderate to weak. The superficial geologies may contribute variable background magnetic texture, though this is unlikely to be particularly strong, except for igneous elements. The available iron content (c. 2.3%) is below the national average, which is typical of soils overlying Lowestoft Formation Diamicton.

3 Discussion

3.1 Introduction

The sections below first discuss the geophysical context within which the results need to be considered and then specific features or anomalies of particular interest. Not all will be discussed here and the reader is advised to consult the graphical elements of this report.

3.2 Principles

Magnetic survey for any purpose relies upon the generation of a clear magnetic anomaly at the surface, i.e. strong enough to be detected by instrumentation and exhibiting sufficient contrast against background variation to permit diagnostic interpretation. The anomaly itself is dependent upon the chemical properties of a particular volume of ground, its magnetic susceptibility and hence induced magnetic field, the strength of any remanent magnetisation, the shape and orientation of the volume of interest and its depth of burial. Finally the choice and configuration of measurement instrumentation will affect anomaly size and shape.

Archaeological sites present a complex mixture of these factors and for some the causative affects are not known. However, depth of burial and size are usually fairly constrained and background susceptibility can be estimated (or measured). The degree of remanent magnetisation is harder to predict and depends on both the natural magnetic properties of the soil and any chemical processes to which it has been subjected. Fortunately heat will raise the susceptibility of most soils and topsoil tends to be more magnetic than subsoil, by volume.

It is hard to draw reliable conclusions about what sort of geology is supportive of magnetic survey as there are many factors involved and in any case magnetic response can vary across geological units as well as being dependent upon post-deposition and erosional processes. In general a relatively non-magnetic parent material contrasting with a magnetisable erosion product, i.e. one which contains iron in the form of oxides and hydroxides, will allow archaeological structures to exhibit strong magnetic contrast against their surroundings and especially if the soil has been heated or subjected to certain processes of fermentation. In the absence of either, magnetic enhancement becomes entirely reliant upon the geochemistry of the soil and enhancement will often be weaker and more variable.

The principal magnetic iron mineral is the oxide magnetite which sometimes occurs naturally but is more often formed during the heating of soil. Subsequent cooling yields a mixture of this, non-magnetic oxide haematite and another magnetic oxide, maghaemite. Away from sources of heat, other magnetic iron minerals include the sulphides pyrite and greigite while in damp soils complex chemistry involving the hydroxides goethite and lepidocrocite can create strong magnetic anomalies. There are thus a number of different geochemical reaction pathways that can both augment and reduce the magnetic susceptibility of a soil. In addition, this susceptibility may exhibit depositional patterns unrelated to visible stratigraphy.

Most structures of archaeological interest detected by magnetic survey are fills within negative or cut features. Not all fills are magnetic and they can be more magnetic or less magnetic than the surrounding ground. In addition, it is common for fills to exhibit variable magnetic properties through their volume, basal primary silt often being more magnetic than the material above it due to the increased proportion of topsoil within it. However, a fill containing burnt soil may be much more magnetic than this primary silt and sometimes a feature that has contained standing water can produce highly magnetic silts through mechanical depositional processes (depositional remanent magnetisation, DRM).

A third structural factor in the detection of buried structures is the depth of topsoil over the feature. As fills sink, the hollow above accumulates topsoil and hence a structure can be detected not through its own magnetisation but through the locally deeper topsoil above it. The volume of soil required depends upon the magnetic susceptibility of the soil but just a few centimetres are often sufficient. Such a thin deposit can, however, easily be lost through subsequent erosion by natural factors or ploughing.

3.2.1 Instrumentation

The use of the magnetic sensors in non-gradiometric (vertical) configuration avoids measurement sensitisation to the shallowest region of the soil, allowing deeper structures, whether natural or otherwise to be imaged within the sensitivity of the instrumentation. However, this does remove suppression of ambient noise and temporal trends which have to be suppressed later during processing. When compared to vertical gradiometers in archaeological use, there is no significant reduction in lateral resolution when using non-gradiometric sensor arrays and the inability of gradiometers to detect laminar structures is completely avoided.

Caesium instrumentation has a greater sensitivity than fluxgate instruments, however, at the 10 Hz sampling rate used here this increase in sensitivity is limited to about one order of magnitude.

The array system is designed to be non-magnetic and to contribute virtually nothing to the magnetic measurement, whether through direct interference or through motion noise.

3.3 Character & principal results

The following paragraphs represent an interpretive summary of the survey. The numbers in square brackets refer to individual anomalies described in detail in the catalogue below and shown on DWG 03 onwards.

3.3.1 Data

The data quality is good, with sufficient contrast existing to allow the detection of known former field boundaries. Therefore, we can be generally confident that fills on the site produce sufficient magnetic contrasts to be detected. There is (expected) interference at the edges of the survey that abut housing, fences and roads.

3.3.2 Geology

The geology across much of the site results in a quiet background environment [15] but to the south this changes to a more mottled and variable response [16]. This is likely to be a combination of factors such as changes in the overall composition of the till, depth of soil and differential weathering of the till surface. This is particularly pronounced in places where there are broad enhanced linear / elongated leaf shaped anomalies [14] being caused by pockets of more magnetic material within the till, likely to be silt in old fluvio-glacial landforms.

3.3.3 Land use

Most of the rest of the anomalies are related to current or former landscape organisation. Anomalies [1-3] are clearly the remains of former field boundaries that show on the earliest (1884) OS county series mapping for the area that were removed sometime between 1978 and 1994 [3] and after 1994 [1-2]. These largely show as enhanced fills, presumably within former drainage or boundary ditches, except for [2] which shows as a series of dipolar anomalies and altered texture, which indicates that either the boundary was constructed differently or the removal method (and subsequent land use) differed.

Aside from the known boundaries there are a number of other linear anomalies (both in the form of enhanced fills and more ambiguous features) that are likely to be the remains of earlier landscape patterns that were not preserved and recorded at the time of the 1884 map. Anomalies [4] and [5] are similar in character and run along the approximate line of the parish boundary marked on the 1884 map and are perhaps therefore related to a parish boundary ditch. The pair of enhanced linear fills marked at [6] are narrower and less intense, and are on a slightly different alignment, orthogonal to the road. It is impossible to say from the data whether these are the remains of a mostly destroyed cultivation pattern or whether they perhaps form part of a system of land plots running from the road. There is a further very similar linear anomaly at [7] and a small run of something much the same at [8], though this is complicated by its relationship with/ proximity to [13]. Anomaly [9] is interpreted as a linear enhanced fill, probably a ditch, as it is both sharper and less intense than the geological banding seen at [14], but the edge of the survey lies here, interrupting the anomaly and it is therefore possible this is a natural feature that we have not been able to fully survey. Anomaly [10] is also more likely to be related to the woodland, and the possibly (complex) remains of a wood-bank or other enclosure system. The small copse is in the same location all the way through the available historical mapping, but we have nothing any earlier than 1884: the proximity to the copse and the overall shape of the anomaly (curving towards the turn in the field boundary) suggest a relationship but this is not certain. On the aerial photograph we have obtained, this anomaly shows as a clear cropmark with greener vegetation, implying a deeper soil. In the aerial photograph there is no boundary between [10] and [11] but there does appear to be a gap or boundary between them in the magnetic data. Anomaly [11] is therefore rather harder to interpret but seems to be similar in character, perhaps representing disturbed ground or tree removal associated with the alteration of the edge of the copse.

Anomaly [12] does not fit with the other linear features on site, and is ambiguous. It consists of a series of small discrete positive anomalies that together form a discernible linear alignment. It is a much less clear version of the type of anomaly seen at [2] which suggests it might be a much older (and therefore more damaged or buried) former field boundary. It may also be natural however.

Anomaly [13] is a reduced linear anomaly, but it is unlikely to be a bank as it co-occurs with a footpath that used to follow the field boundary but which has clearly shifted west since the removal. This is visible as a bright linear (presumably with no crop) in the aerial photograph.

3.3.4 Archaeology

Aside from the potential for datable materials within the fills of the linear boundaries and ditches discussed above, there are no specific features of archaeological interest within this dataset. There is an outside possibility that [10], rather than being associated with the woodland instead is part of a ditch associated with the slight rise under the present copse and to the south and west of it, though it would be incorrect to speculate about what that could be.

3.4 Conclusions

The survey has identified a palimpsest of previously known and unknown linear landscape divisions representing former field systems and boundaries. Some of these are ambiguous in character and are likely to relate to the existing copse of trees but they could also pre-date this and relate to a slight rise in the ground at this location.

3.5 Catalogue

The numbers in square brackets in this report refer to the catalogue below and DWG 03.

Label	Anomaly Type	Feature Type	Comments
1	Strong Enhanced Linear	Fill: Former Boundary	Runs along line of former field boundary seen on earlier OS mapping, and current footpath
2	Variable Linear	Debris: Former Boundary	Runs along line of former field boundary seen on earlier OS mapping, and current footpath. Different agricultural management, or different removal method explains the differences between this and [1]
3	Strong Enhanced Linear	Fill: Former Boundary	Runs along line of former field boundary seen on earlier OS mapping
4	Weak Enhanced Linear	Fill: Boundary? Ditch?	In approximate location of Parish boundary as shown on 1884 OS mapping, continues as [5]?
5	Weak Enhanced Linear	Fill: Boundary? Ditch?	In approximate location of Parish boundary as shown on 1884 OS mapping, continues as [4]?
6	Weak Enhanced Linear Group	Fill: Ditch?	Orthogonal to road, a series of weak linear anomalies. Possibly the remains of an earlier landscape organisation or cultivation pattern

7	Weak Enhanced Linear	Fill: Ditch?	Orthogonal to road. Possibly the remains of an earlier landscape organisation or cultivation pattern. Similar to [6] but on a slightly different orientation
8	Weak Enhanced Linear	Fill: Ditch?	Orthogonal to road, on the same alignment as [14] and perhaps a component of the same feature
9	Weak Enhanced Linear	Fill: Ditch?	Weak and without sharp edges. Possibly related to [10]
10	Texture / Area	Fill: Ditch?	Complex anomaly with a linear enhanced fill at the southern end that gradually becomes a curving texture change with diffuse but clear boundaries. Assumed to be related to the copse of trees it bounds, probably reflecting an earlier wood bank (that pre-dates 1884 as the wood has its current extent by then). The strong dipole within this anomaly neatly corresponds to a pond shown on the 1884 map and is likely to be debris used to fill said pond. This whole anomaly shows as a clear 'wetter' crop mark in the AP. Could also be unrelated to trees and instead to slightly higher ground immediately south and west in next field.
11	Texture / Area	Fill?	Bounded area of different texture similar to the northern curved part of [10], also shows as greener vegetation in AP. Likely to be a thin fill or patch of disturbed ground
12	Linear Texture	Debris or Fill	Linear alignment of small enhanced anomalies and changes to the background. Possible former ditch or boundary, or recent surface compaction leading to a very weak anomaly
13	Weak Reduced Linear	Texture	Orthogonal to road, on the same alignment as [8] and perhaps a component of the same feature. Bright line in AP on same alignment so could also be modern footpath compaction / topographic changes from agriculture
14	Strong Enhanced Area (sample)	Natural	Enhanced deposits within the fluvio-glacial sheet deposits underlying the site
15	Texture Sample	Natural	Example of the background texture where the fluvio-glacial deposits are either more varied in their makeup or are less deeply buried
16	Texture Sample	Natural	Background texture with small enhanced anomalies from components of the fluvio-glacial deposits but where other variation is less, either due to a different mixture or a greater overlying soil depth
17	Weak Enhanced Linear (sample)	Cultivation	Sample of weak and intermittent linear enhancement that runs along the same alignment as boundary [3] in multiple areas to the south of that boundary. Likely to be the remains of former cultivation patterns.

3.6 Caveats

Geophysical survey is reliant upon the detection of anomalous values and patterns in physical properties of the ground, e.g. magnetic, electromagnetic, electrical, elastic, density and others. It does not directly detect underground features and structures and therefore the presence or absence of these within a geophysical interpretation is not a direct indicator of presence or absence in the ground. Specific points to consider are:

- some physical properties are time variant or mutually interdependent with others;
- for a buried feature to be detectable it must produce anomalous values of the physical property being measured;
- any anomaly is only as good as its contrast against background textures and noise within the data.

TigerGeo will always attempt to verify the accuracy and integrity of data it uses within a project but at all times its liability is by necessity limited to its own work and does not extend to third party data and information. Where work is undertaken to another party's specification any perceived failure of that specification to attain its objective remains the responsibility of the originator, TigerGeo meanwhile ensuring any possible shortcomings are addressed within the normal constraints upon resources.

4 Methodology

4.1 Survey

4.1.1 Technical equipment

Measured variable	Magnetic flux density / nT
Instrument	Array of Geometrics G858 Magmapper caesium magnetometers
Configuration	Non-gradiometric transverse array (4 sensors, ATV towed)
Sensitivity	0.03 nT @ 10 Hz (manufacturer's specification)
QA Procedure	Continuous observation
Spatial resolution	1.0m between lines, 0.25m mean along line interval

4.1.2 Monitoring & quality assessment

The system continuously displays all incoming data as well as line speed and spatial data resolution per acquisition channel during survey. Rest mode system noise is therefore easy to inspect simply by pausing during survey, and the continuous display makes monitoring for quality intrinsic to the process of undertaking a survey. Rest mode test results (static test) are available from the system.

4.2 Data processing

4.2.1 Procedure

All data processing is minimised and limited to what is essential for the class of data being collected, e.g. reduction of orientation effects, suppression of single point defects (drop-outs or spikes) etc. The processing stream for this data is as follows:

Process	Software	Parameters
Measurement & GNSS receiver data alignment	Proprietary	
Temporal reduction, regional field suppression	Proprietary	Bandpassed 0.3 – 10.0s
Gridding	Surfer	Kriging, 0.25m x 0.25m
Smoothing	Surfer	Gaussian lowpass 0.75m
Imaging and presentation	Manifold GIS	

Potential field processing procedures are used where possible on gridded data from the above processing, allowing simulation of vertical gradient data, separation of deep and shallow magnetic sources, etc. The initial processing uses proprietary software developed in conjunction with the multisensor acquisition system. Gridded data is ported as data surfaces (not images) into Manifold GIS for final imaging and detailed analysis. Specialist analysis is undertaken using proprietary software.

4.3 Interpretation

4.3.1 Introduction

Numerous sources are used in the interpretive process, which takes into account shallow geological conditions, past and present land use, drainage, weather before and during survey, topography and any previous knowledge about the site and the surrounding area. Old Ordnance Survey mapping is consulted and also older sources if available. Geological information (for the UK) is sourced only from British Geological Survey resources and aerial imagery from online sources. LiDAR data is usually sourced from the Environment Agency or other national equivalents, SAR from NASA and other topographic data from original survey.

Information from nearby surveys is consulted to inform upon local data character, variations across soils and near-surface geological contexts. Published data from other contractors may also be used if accompanied by adequate metadata.

4.3.2 Geological sources – magnetic character

On some sites, e.g. some gravels and alluvial contexts, there will be anomalies that can obscure those potentially of archaeological interest. They may have a strength equal to or greater than that associated with more relevant sources, e.g. ditch fills, but can normally be differentiated on the basis of anomaly form coupled with geological understanding. Where there is ambiguity, or relevance to the study, these anomalies will be included in this category.

Not all changes in geological context can be detected at the surface, directly or indirectly, but sometimes there will be a difference evident in the geophysical data that can be attributed to a change, e.g. from alluvium to tidal flat deposits, or bedrock to alluvium. In some cases the geophysical difference will not exactly coincide with the geological contact and this is especially the case across transitions in soil type.

Geophysical data varies in character across areas, due to a range of factors including soil chemistry, near surface geology, hydrology and land use past and present. These all contribute to the texture of the data, i.e. a background character against which all other anomalies are measured.

4.3.3 Agricultural sources - magnetic character

Coherent linear dipolar enhancement of magnetic field strength marking ditch fills, narrow bands of more variable magnetic field or changes in apparent magnetic susceptibility, are all included within the category of former field boundaries if they correlate with those depicted on the Tithe Map or early Ordnance Survey maps. If there is no correlation then these anomaly types are not categorised as a field boundaries.

Banded variations in apparent magnetic susceptibility caused by a variable thickness of topsoil, depositional remanent magnetisation of sediments in furrows or susceptibility enhancement through heating (a by product of burning organic matter like seaweed) tend to indicate past cultivation, whether ridge-based techniques, medieval ridge and furrow or post medieval 'lazy beds'. Modern cultivation, e.g. recent ploughing, is not included.

In some cases it is possible to identify drainage networks either as ditch-fill type anomalies (typically 'Roman' drains), noisy or repeating dipolar anomalies from terracotta pipes or reduced magnetic field strength anomalies from culverts, plastic or non-reinforced concrete pipes. In all cases identification of a herring bone pattern to these is sufficient for inclusion within this category.

4.3.4 Archaeological sources – magnetic character

Any linear or discrete enhancement of magnetic field strength, usually with a dipolar character of variable strength, that cannot be categorised as a field boundary, cultivation or as having a geological origin, is classified as a fill potentially being of archaeological interest. Fills are normally earthen and include an often invisible proportion of heated soil or topsoil that augments local magnetic field strength. Inverted anomalies are possible over non-earthen fills, e.g. those that comprise peat, sand or gravel within soil. This category is subject to the 'habitation effect' where, in the absence of other sources of magnetic material, anomaly strength will decrease away from sources of heated soil and sometimes to the extent of non-detectability.

Former enclosure ditches that contained standing water can promote enhanced volumetric magnetic susceptibility through depositional remanence and remain detectable regardless of the absence of other sources of magnetic enhancement.

Anything that cannot be interpreted as a fill tends to be a structure, or in archaeological terms, a feature. This category is secondary to fills and includes anomalies that by virtue of their character are likely to be of archaeological interest but cannot be adequately described as fills. Examples include strongly magnetic bodies lacking ferrous character that might indicate hearths or kilns. In some cases anomalies of ferrous character may be included.

On some sites the combination of plan form and anomaly character, e.g. rectilinear reduced magnetic field strength anomalies, might indicate the likely presence of masonry, robber trenches or rubble foundations.

Other types of structure are only included if the evidence is unequivocal, e.g. small ring ditches with doorways and hearths. In some circumstances a less definite category may be assigned to the individual anomalies instead.

It is sometimes possible to define different areas of activity on the basis of magnetic character, e.g. texture and anomaly strength. These might indicate the presence of middens or foci within larger complexes. This category does not indicate a presence or absence of discrete anomalies of archaeological interest.

4.4 Bibliography & selected reference

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4.5 Archiving and dissemination

An archive is maintained for all projects, access to which is permitted for research purposes. Copyright and intellectual property rights are retained by TigerGeo on all material it has produced, the client having full licence to use such material as benefits their project. Where required, digital data and a copy of the report can be archived in a suitable repository, e.g. the Archaeology Data Service, in addition to our own archive.

The archive contains all survey and project data, communications, field notes, reports and other related material including copies of third party data (e.g. CAD mapping, etc.) in digital form. Many are in proprietary formats while report components are available in PDF format.

The client will determine the distribution path for reporting, including to the end client, other contractors, local authority etc., and will determine the timetable for upload of the project report to the OASIS Grey Literature library or supply of report or data to other archiving services, taking into account end client confidentiality.

TigerGeo reserves the right to display data rendered anonymous and un-locatable on its website and in other marketing or research publications.

4.6 Acknowledgements

With thanks to Myk Flitcroft for facilitating the survey.

5 Supporting information

5.1 Standards and quality (archaeology)

TigerGeo meets with ease the requirements of English Heritage in their 2008 Guidance "Geophysical Survey in Archaeological Field Evaluation" section 2.8 entitled "Competence of survey personnel".

The management team at TigerGeo have over 30 years of combined experience of near surface geophysical project design, survey, interpretation and reporting, based across a wide range of shallow geological contexts. Added to this is the considerable experience of our lead geophysicists in a variety of commercial and academic roles. All geophysical staff have graduate and in many cases also post-graduate relevant qualifications pertaining to environmental geophysics from recognised centres of academic excellence.

A high standard of client-centred professionalism is maintained in accordance with the requirements of relevant professional bodies including the Geological Society of London (GeolSoc) and the Chartered Institute for Archaeologists (CIfA). Senior members of TigerGeo are professional members of the GeolSoc (FGS), CIfA (MCIfA & ACIfA grades) and other appropriate bodies, including the European Association of Geoscientists and Engineers (EAGE) Near Surface Division (MEAGE) and the Institute of Professional Soil Scientists (MISoilSci).

During fieldwork there is always a fully qualified (to graduate or post-graduate level) supervisory geophysicist leading a team of other geophysicists and geophysical technicians, all of whom are trained and competent with the equipment they are working with. Data processing and interpretation is carried out by a suitably qualified and experienced geophysicist under the direct supervision and guidance of the Senior Geophysicist. All work is monitored and reviewed throughout by the Senior Geophysicist who will appraise all stages of a project as it progresses.

Data processing and interpretation adheres to the scientific principles of objectiveness and logical consistency. A standard set of approved external sources of information, e.g. from the British Geological Survey, the Ordnance Survey and similar sources of data, in addition to previous TigerGeo projects, guide the interpretive process. Due attention is paid to the technical constraints of method, resolution, contrast and other geophysical factors.

There is a strong culture of internal peer-review within TigerGeo, for example, all reports pass through a process of authorship, technical review and finally proof-reading before release to the client. Technical queries resulting from TigerGeo's work are reviewed by the Senior Geophysicist to ensure uniformity of response prior to implementing any edits, etc.

All work is conducted in accordance with the following standards and guidance:

- David et al, "Geophysical Survey in Archaeological Field Evaluation", English Heritage, 2008;
- "Standard and guidance for Archaeological Geophysical survey", Chartered Institute for Archaeologists, 2014;

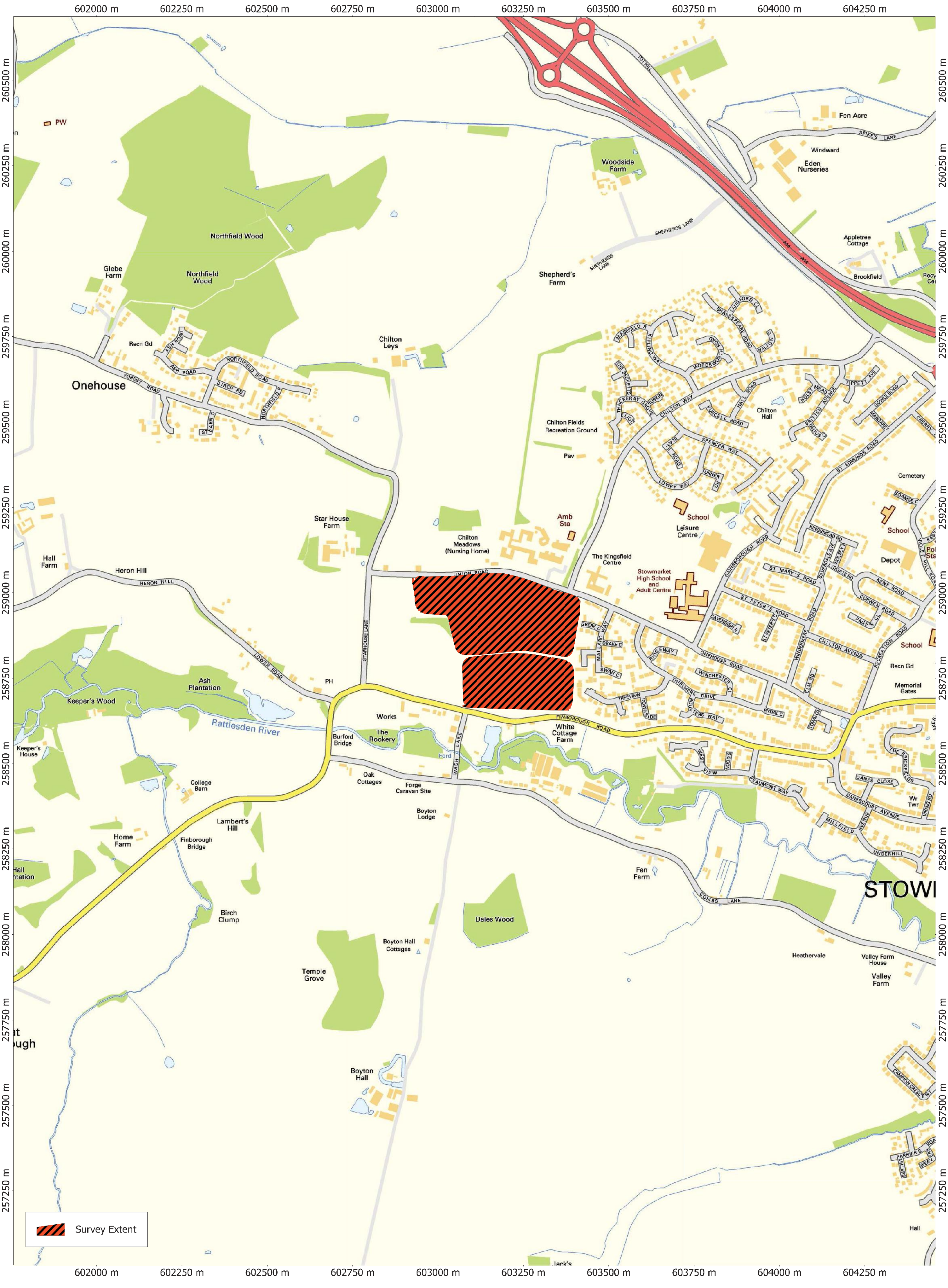
and undertaken in accordance with the high professional standards and technical competence expected by the Geological Society of London and the European Association of Geoscientists and Engineers.

TigerGeo is in the process of applying to the Chartered Institute for Archaeologists to become a Registered Organisation. ISO 9001 and 14001 accreditation is also sought.

5.2 Who we are

Senior Geophysicist (Quality manager)	Martin Roseveare MSc BSc(Hons) MEAGE FGS MCIfA
Martin specialised (MSc) in geophysical prospection for shallow applications at the University of Bradford in 1997 and has worked in commercial geophysics since then. He was elected a Fellow of the Geological Society of London in 2009 and is now working towards achieving CSci. He is a full member of the Chartered Institute of Archaeologists and a member of the Near Surface division of the European Association of Geoscientists & Engineers. He serves on the EuroGPR and CIfA GeoSIG committees and has served on the scientific committees of the 10th and 11th Archaeological Prospection conferences, has reviewed papers for the EAGE Near Surface conference, was a technical reviewer of the Irish NRA geophysical guidance and is also a founding member of the ISSGAP soils group. Martin is also a former tutor for archaeological geophysics at Birkbeck College, London. Professional interests include the application of geophysics to agriculture and the environment, e.g. groundwater and geohazards. He is also a software writer and equipment integrator with significant experience of embedded systems. Beyond the day job Martin has worked in technical theatre, is an aspirant lighting designer and is being classically trained in tabla playing.	
Operations Manager (Safety manager)	Anne Roseveare BEng(Hons) DIS MISoilSci
On looking beyond engineering, Anne turned her attention to environmental monitoring and geophysics and has since been applying specialist knowledge of chemistry & fluid flow to soils. She is member of the British Society of Soil Science and is interested in the use of agricultural applications of geophysics. Anne was the founding editor of the International Society for Archaeological Prospection (ISAP) and has spent many years walking fields in parallel lines. Much of her time now is spent managing complicated scheduling and logistics, overseeing safety procedures and data handling, while dreaming of interesting places around the world to undertake surveys, including researching the urban archaeology of Asia. Closer to home she is a student of the classical Indian dance form, kathak and is learning Hindi.	
Lead Geophysicist (Archaeology)	Dr. Kayt Armstrong PhD MSc BA(Hons)
Kayt completed her PhD at the University of Bournemouth (UK) in 2010, looking at geophysical approaches to archaeological prospection in peat. She held a post-doctoral position at the University of Groningen from 2011-2014, working on rural Bronze Age settlements in Southern Italy, and Roman roadside settlements along the via Appia. This was followed by an appointment at the Institute for Mediterranean Studies FORTH in Crete. Her research interests include geophysics, social archaeology, GIS, and prehistory. She is particularly interested in extending conventional surveys into unconventional environments, and when she isn't running around a field doing geophysics, she's running around a field chasing orcs.	
Lead Archaeologist	Daniel Lewis MA BA(Hons) ACIfA
Daniel studied archaeology at the University of Nottingham and worked in field archaeology for many years, managing urban and rural fieldwork projects in and around Herefordshire. When the desk became more appealing Dan jumped into the world of consulting, working on small and large multi-discipline projects throughout England and Wales. At the same time, he returned to University, studying a part time MA in Historic Environment Conservation. With over 15 years experience in the heritage sector, Daniel has a diverse portfolio of skills. Here he ensures that geophysical work within the heritage sector is well grounded in the archaeology. His spare time includes much running up mountains.	
Geophysicist	Kathryn Cunningham BSc(Hons) FGS
Kathryn's interest in geology began while working as a nature guide in the Kruger National Park in South Africa. This motivated her to earn a BSc (Hons) in Applied Geology at Plymouth University (GeolSoc accredited degree) with interests in field work, GIS and engineering geology. Upon graduating in 2015, she then joined TigerGeo and has not looked back. Her role in TigerGeo primarily involves ensuring the smooth	

running of field work in a range of methods, with increasing responsibilities involving processing and interpretation. Outside of the working week, she usually enjoys acrobatics and jigsaws.	
Geophysicist	Jack Wild BSc(Hons)
Down to earth and a recent Plymouth University graduate in geology (GeolSoc accredited degree) Jack entered the world of shallow geophysics with an Atkinson Leapfrog. Happiest when in the field he has undertaken geological projects Europe wide including in Sicily and the Spanish Pyrenees and closer to home has studied much of the Cornish and Devon coast. The mystery of what lies below drives his interest in the collection and interpretation of high quality data - be it from magnetometry or GPR he just can't resist(ivity)!	



USS161 Land off Union Road, Stowmarket, Suffolk
DWG 01 Location

Orthographic Scale: 1:10000 @ A3 Spatial Units: Meter. Do not scale off this drawing
File: USS161.map

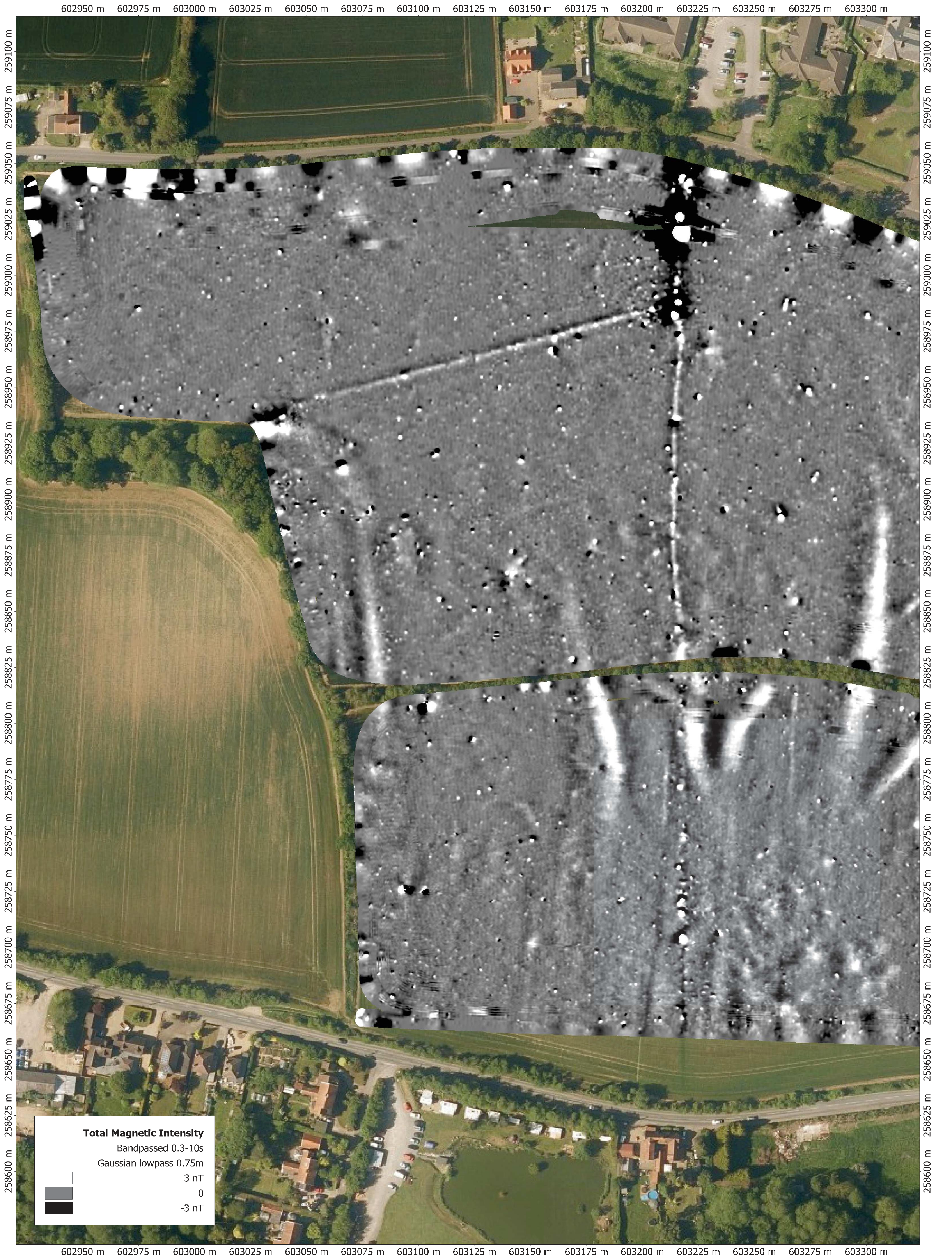
TIGERGEO

USS161 Land off Union Road, Stowmarket, Suffolk

DWG 02 Total Magnetic Intensity

Orthographic Scale: 1:2500 @ A3 Spatial Units: Meter. Do not scale off this drawing

TIGERGEO

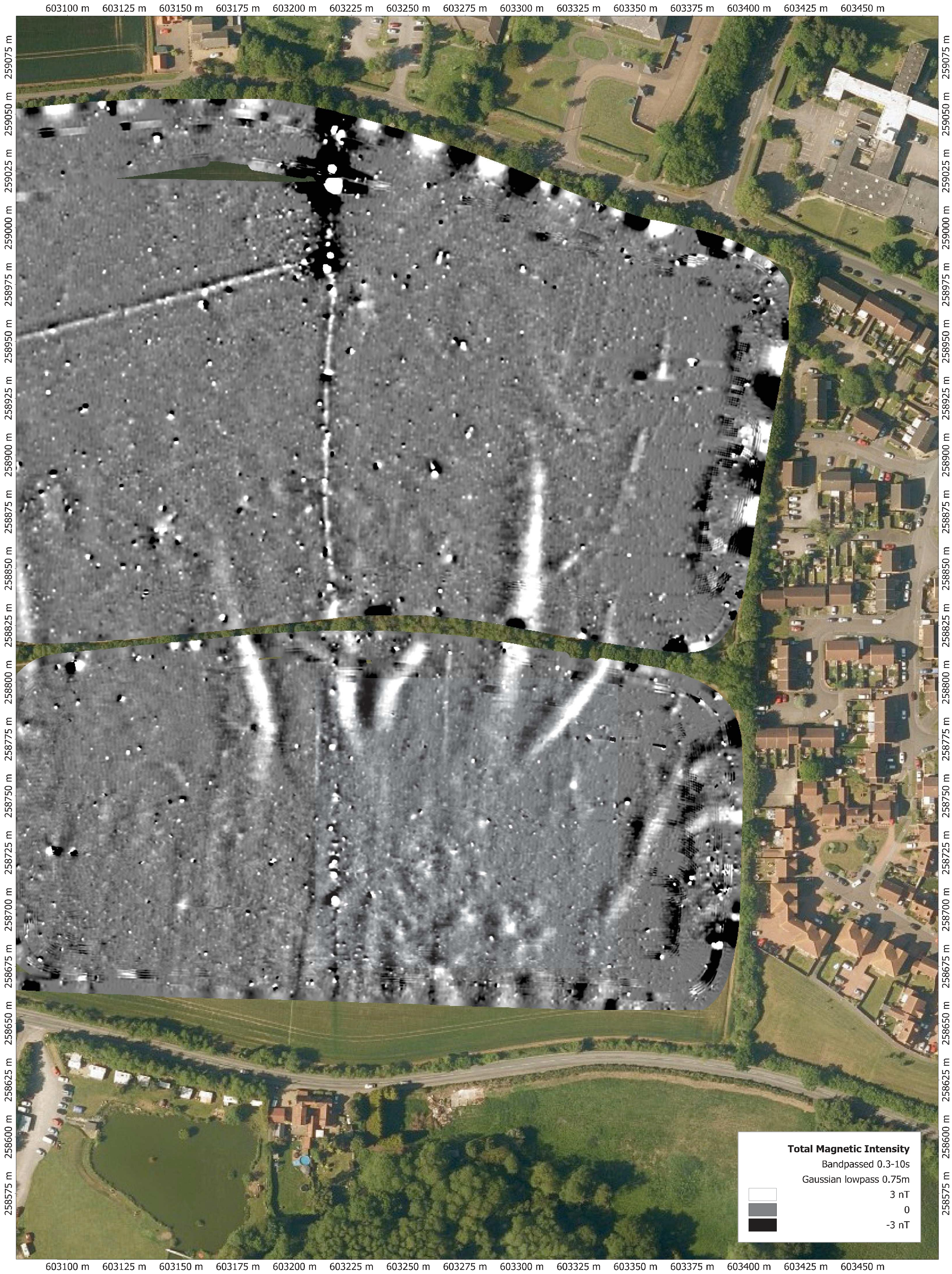


USS161 Land off Union Road, Stowmarket, Suffolk

DWG 02a Total Magnetic Intensity (West)

Orthographic Scale: 1:1500 @ A3 Spatial Units: Meter. Do not scale off this drawing

TIGERGEO



USS161 Land off Union Road, Stowmarket, Suffolk

DWG 02b Total Magnetic Intensity (East)

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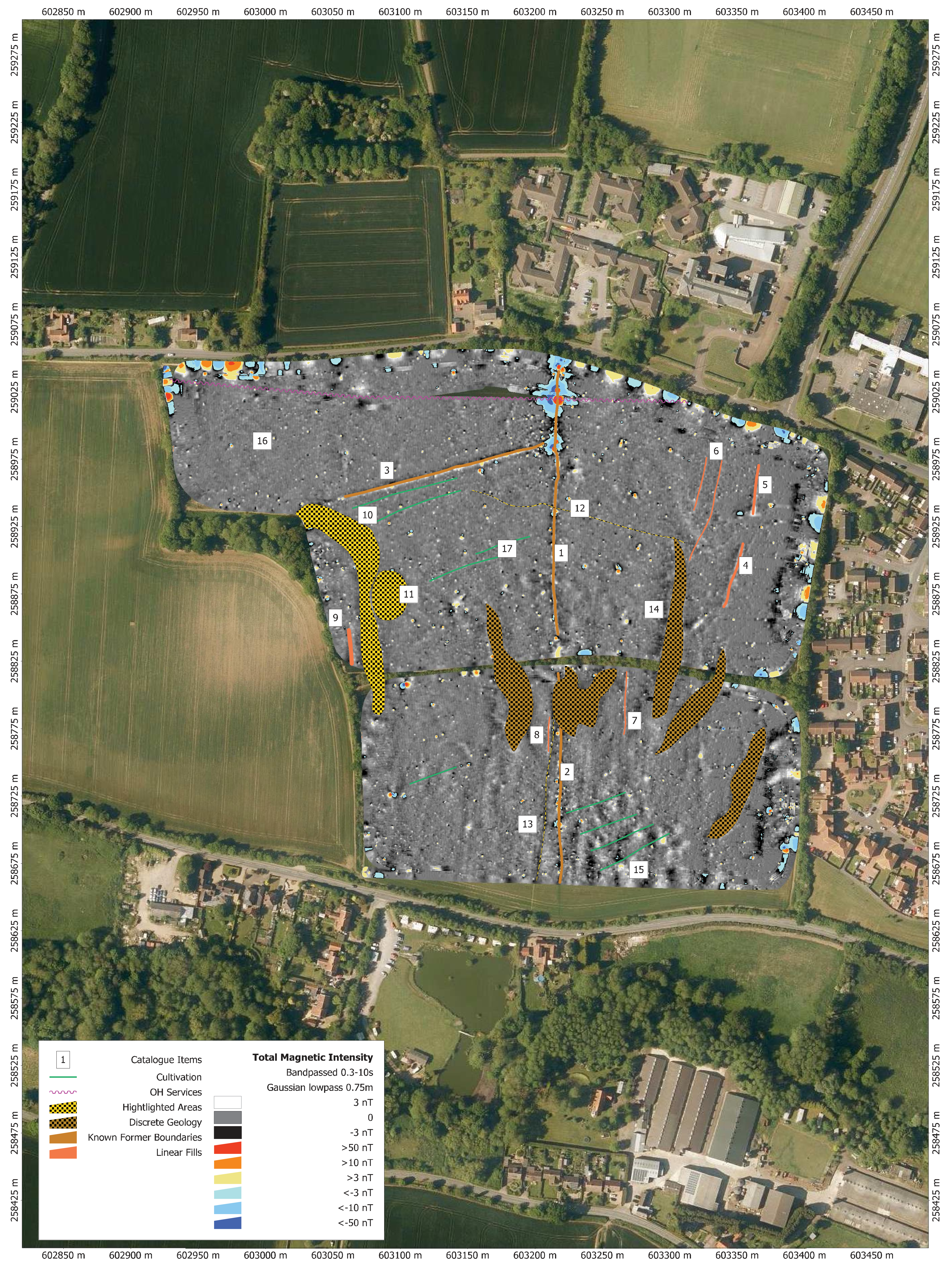

USS161 Land off Union Road, Stowmarket, Suffolk
DWG 03 Interpretation

Orthographic Scale: 1:2500 @ A3 Spatial Units: Meter. Do not scale off this drawing
File: USS161.map

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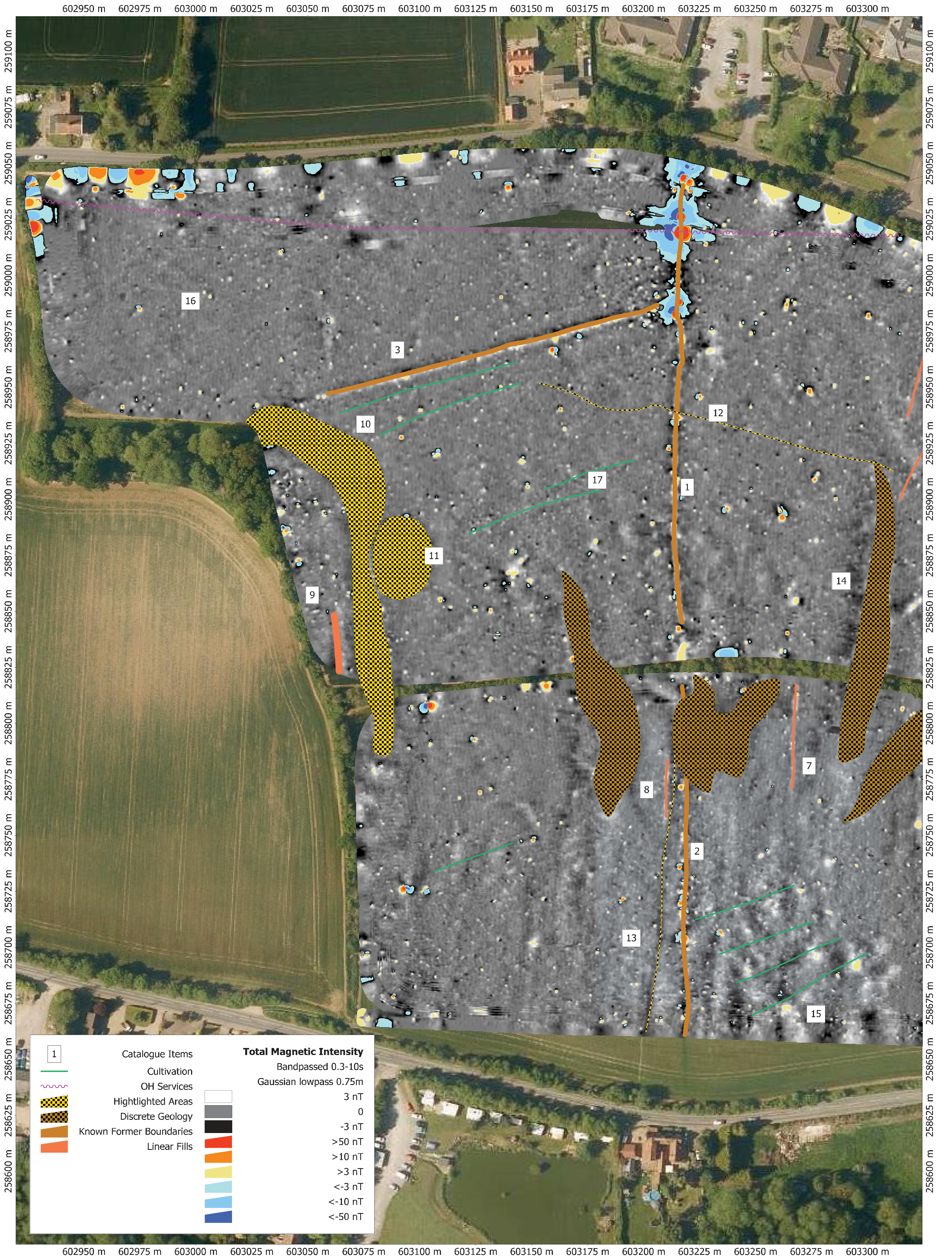

USS161 Land off Union Road, Stowmarket, Suffolk

DWG 03a Interpretation (West)

Orthographic Scale: 1:1500 @ A3 Spatial Units: Meter. Do not scale off this drawing

File: USS161.map

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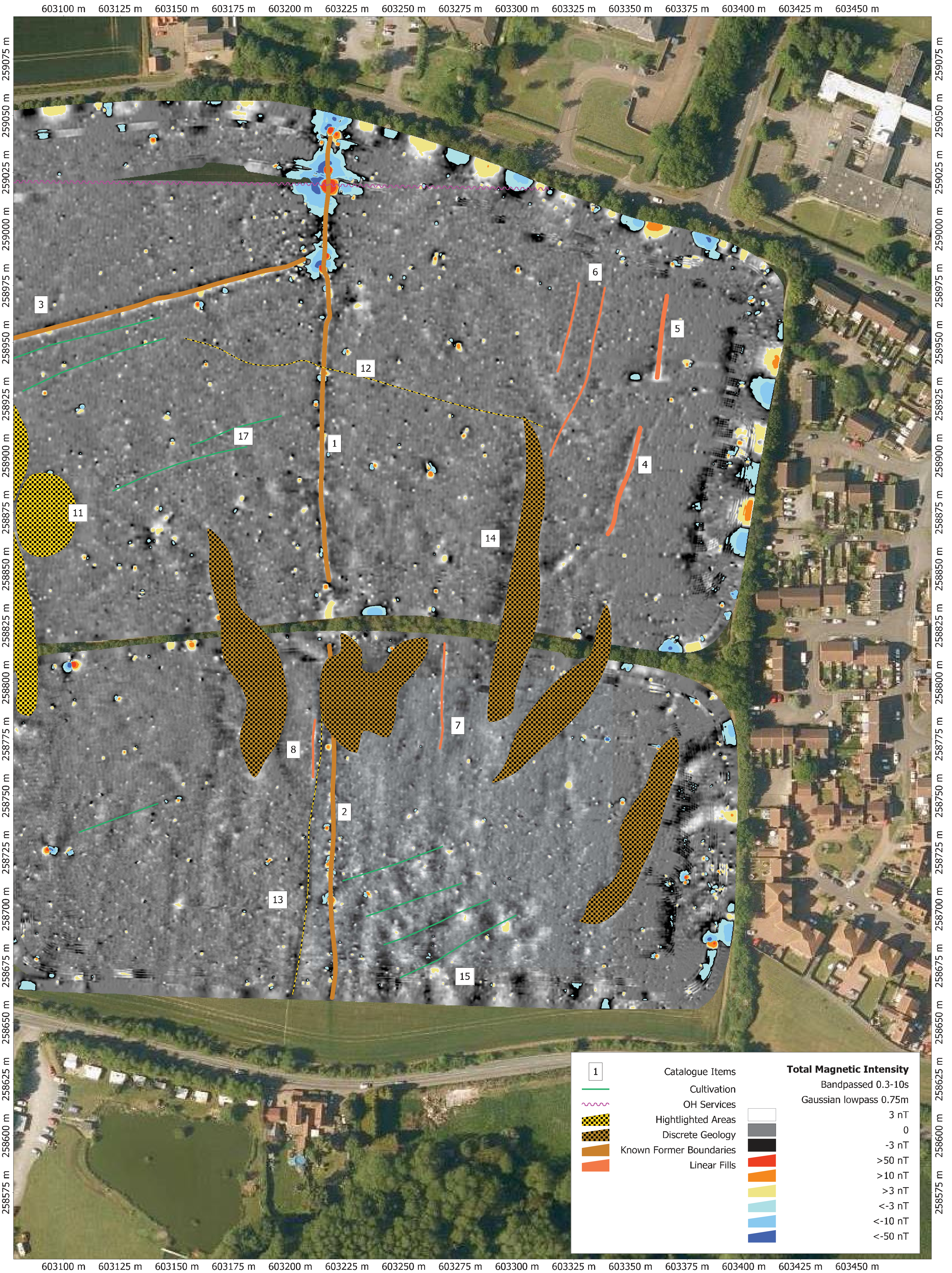

USS161 Land off Union Road, Stowmarket, Suffolk
DWG 03b Interpretation (East)

Orthographic Scale: 1:1500 @ A3 Spatial Units: Meter. Do not scale off this drawing

TIGERGEO