ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
BAM Nuttall Mott MacDonald Joint Venture (BMMJV)

SABIC Wetland (South)
Greatham
Stockton-on-Tees

geophysical survey

report 4742
March 2018

Durham University

Contents

Figures

Green Lane · Durham · DH1 3LA · tel 0191 334 1121 · fax 0191 334 1126
archaeological.services@durham.ac.uk · www.dur.ac.uk/archaeological.services

1. Summary

The project

1.1 This report presents the results of a geophysical survey conducted in advance of proposed development of a new intertidal habitat at Greatham South, Cowpen Marsh, Greatham Creek, Stockton-on-Tees. The works comprised detailed geomagnetic survey of approximately 4.5ha.

1.2 The works were commissioned by BAM Nuttall Mott MacDonald Joint Venture (BMMJV) and conducted by Archaeological Services Durham University.

Results

1.3 The courses of former creeks have been identified; these are almost certainly filled with a variety of different materials, including, in some instances, probable clinker, slag or brick rubble. The courses of some of these creeks are shown on mid-20th-century Ordnance Survey maps.

1.4 A wide band of disturbed ground has been detected across the northern part of the area, which may represent a former water channel or possibly ground disturbance associated with the construction of the adjacent reservoirs.

1.5 Plough furrows have been detected across the area.

1.6 No features of likely archaeological significance have been identified in the survey.

2. Project background

Location (Figure 1)

2.1 The survey area was located at SABIC Wetland (South), Greatham South, Cowpen Marsh, Greatham Creek, Stockton-on-Tees (NGR centre: NZ 4960 2390). To the east were the Saltholme brine reservoirs, to the south was the A1185 road and to the north and west was agricultural land.

2.2 One survey of approximately 4.5ha was conducted across part of one pasture field. A 6m buffer was left unsurveyed along the north-western edge of the area at the request of the project ecologist.

Development proposal

2.3 The proposed scheme aims to create a new intertidal habitat by raising existing embankments and creating new ones. It is proposed that material needed for the creation of these embankments will be sourced from low lying areas of the site and works on this site will be limited to removal of soil.

Objective

2.4 The aim of the survey was to assess the nature and extent of any sub-surface features of potential archaeological significance within the survey area, so that an informed decision may be made regarding the nature and scope of any further scheme of archaeological works that may be required in relation to the development.

2.5 The regional research framework *Shared Visions: The North-East Regional Research Framework for the Historic Environment* (Petts & Gerrard 2006) contains an agenda for archaeological research in the region, which is incorporated into regional planning policy implementation. In this instance, the scheme of works was designed to address the following research priorities: Late Bronze Age and Iron Age Iii. Settlement, Iiii. Landscapes; Roman Ri. The Iron Age to Roman transition, Riv. Native and civilian life, Rix. Landscape and environment; Early Medieval EMi: Landscape, EMii: Settlement; Later Medieval MDi. Settlement, MDii. Landscape.

Methods statement

2.6 The surveys have been undertaken in accordance with a Project Design provided by BMMJV, a Written Scheme of Investigation provided by Archaeological Services Durham University and national standards and guidance (see para. 5.1 below).

Dates

2.7 An initial site visit to establish suitability for survey was undertaken on 13th March 2018; subsequent fieldwork was undertaken on 22nd March 2018. This report was prepared for March 2018.

Personnel

2.8 Fieldwork was conducted by Daniel Adamson and Duncan Hale. The geophysical data were processed by Duncan Hale. This report was prepared by Richie Villis, with illustrations by David Graham, and edited by Duncan Hale, the Project Manager.

Archive/OASIS

2.9 The site code is **GSW18**, for **G**reatham **S**ABIC **W**etland **2018**. The survey archive will be retained at Archaeological Services Durham University and a copy supplied on CD

to the client for deposition with the project archive in due course. Archaeological Services Durham University is registered with the **O**nline **A**cces**S** to the **I**ndex of archaeological investigation**S** project (**OASIS**). The OASIS ID number for this project is **archaeol3-312943**.

3. Historical and archaeological background

3.1 The following background information is taken from the Project Design provided by BMMJ and is presented here with only minor alterations.

3.2 This archaeological and historical background has been drawn from information gathered for the Environmental Impact Assessment (EIA) for Port Clarence and Greatham South Flood Alleviation Scheme (EA 2014, supplemented 2016). This was supplemented by an Archaeological Watching Brief maintained on Ground Investigation (GI) work undertaken as part of initial feasibility studies on the use of the geological material for a borrow pit.

3.3 Evidence for prehistoric activity south of Greatham Creek is limited to Bronze Age animal remains and a prehistoric midden. An extensive prehistoric settlement has been found north of Greatham Creek (NAA 2015), increasing the likelihood of prehistoric salt working on this site.

3.4 There is no evidence for Romano-British activity in the survey area, although evidence of roundhouses and Roman pottery have been uncovered north of Greatham Creek, suggesting occupation occurred during the Romano-British period (NAA 2015). There is no evidence for early medieval activity in the survey area, however, the surrounding area has evidence of settlement in this period.

3.5 The archaeological record demonstrates utilisation of natural resources within the area in the medieval period. To the north of the survey area and south of Greatham Creek were 22 recorded saltern sites, with two salterns located within 500m of the site. Salterns are the remains of salt works or salt production sites, usually surviving as earthworks. Salt production is believed to have begun in the 12th century and came to an end in the mid-17th century once the area had been inundated with water, ruining the saltcotes and leading to the abandonment of the industry (Page 1928). Salt production occurred in the 19th century using different techniques of boreholes and solution mining and ultimately ended in the 1970s.

3.6 The Second World War had a major impact on the area. The surrounding area was hit by two high explosive devices, leaving two craters, one of which is located within 500m of the site. The 'Greatham Creek Defence Area' altered the landscape of the Marsh, including the construction of three section posts, a pillbox and a road built by prisoners of war. A Second World War bomb decoy site is situated some 120m from the site. This is a QL/QF site, which means it was a night structure which utilised a combination of diversionary fire (QF), simulated urban lighting (QL) and dummy buildings. Only 100 QF sites were operational in England, meaning any significant surviving remains would be considered of national importance according to Historic England (Historic England 2003).

Previous archaeological works

3.7 There have been five previous archaeological investigations in the surrounding area:

- Ground Investigation (GI) was undertaken by Mott MacDonald in 2016 during an earlier phase of the project. This was accompanied by an archaeological watching brief. It revealed organic material in the form of a layer of dark brown peat which, although undated, is likely to be associated with palaeo-channels that extend across the salt marsh.

- North of Greatham Creek (approximately 1.8km north of the site) a large-scale prehistoric settlement was uncovered in 2012 by the Northern Archaeological Associates (NAA). Flint tools, pottery fragments, jet jewellery, an arrowhead, flint thumbnail scrapers, Bronze Age blades and ancient burial mounds were discovered (NAA 2015).

- In 1979 and 1993 a saltern mound located c.1.85km from the site was excavated revealing a series of small clay-lined bowl- shaped features intended to hold seawater, a 13th-century "Hartpool Ware" pottery shard and rectangular features, presumed to be hearths.

- Two salterns were excavated between May and June 2017 by Archaeological Services (Archaeological Services 2017a). These excavations revealed a thick layer of yellow-brown clay on both sites, which was interpreted as waste material from the 'sleeching process'. No artefacts were uncovered and ten palaeo-environmental samples were taken for further evaluation.

- Archaeological Services dug a trial trench through the 18th-century sea wall in June 2017, approximately 1km from the site (Archaeological Services 2017b). It revealed that the two ridges previously believed to be part of the same sea wall were in fact two different structures, the sea wall and a separate road built by prisoners of war in the 20th century.

Archaeological potential

3.8 The site lies on marginally higher land on the southern edge of the Cowpen Marsh. This would have been at the upper edge of the tidal reaches of Greatham Creek. Prehistoric activity has been excavated on similar topographic locations north of Greatham Creek and the site may have been suitable for prehistoric occupation. Furthermore, there is high potential for organic peat deposits containing paleo-environmental evidence from all periods associated with former palaeo-channels to be found on site. Overall the potential for prehistoric archaeological remains on the site is medium.

3.9 There is minimal evidence of Romano-British or early medieval activity in proximity to this site. This is limited to the Romano-British period roundhouses north of Greatham Creek and etymological evidence of surrounding Anglo-Scandinavian settlements from the early medieval period. There is low potential for Romano-British or early medieval archaeological deposits on site. However, the absence of material evidence such as pottery in the early medieval period is common and an absence of archaeological evidence does not preclude activity on the site.

3.10 Documentary and archaeological evidence suggest that there were medieval monastic salt works north of the site that continued into the post-medieval period.

However, there is no topographic evidence of salterns on the site. There is still the potential for buried archaeological remains of salt working and associated infrastructure away from the main tidal reaches. There is moderate to high potential for medieval and post-medieval archaeological remains on this site. There is low potential of any significant modern finds as there is minimal evidence of activity during this period within the immediate vicinity of the site.

4. Landuse, topography and geology

4.1 At the time of survey the survey area comprised part of a pasture field. Standing water up to 0.4m deep was present across large parts of the area. It was not possible to collect data in two very small regions of deeper water and soft mud in the north-eastern part of the survey area. A 6m buffer was left unsurveyed along the north-western edge of the area at the request of the project ecologist. Recently bored and capped geotechnical boreholes were present in the survey area. The area was bounded to the north, east and south-west by fences.

4.2 The site lies on the southern edge of Cowpen Marsh, on marginally higher land. Cowpen Marsh is generally flat, low-lying reclaimed salt marsh with ground levels close to sea level (between 2-3m OD). It is interspersed with small former intertidal creeks that have partially dried out since being cut off from Greatham Creek after land reclamation has occurred. The survey area was predominantly level with a mean elevation of approximately 5m OD.

4.3 The underlying solid geology of the area comprises Permian and Triassic strata of the Sherwood Sandstone Group, which are overlain by Devensian glaciolacustrine deposits of clay and silt in the south and tidal flat deposits of sand, clay and silt in the north.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with Historic England guidelines, *Geophysical survey in archaeological field evaluation* (David, Linford & Linford 2008); the Chartered Institute for Archaeologists (CIfA) *Standard and Guidance for archaeological geophysical survey* (2014); the CIfA Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service & Digital Antiquity *Geophysical Data in Archaeology: A Guide to Good Practice* (Schmidt 2013).

Technique selection

5.2 Geophysical survey enables the relatively rapid and non-invasive identification of sub-surface features of potential archaeological significance and can involve a suite of complementary techniques such as magnetometry, earth electrical resistance, ground-penetrating radar, electromagnetic survey and topsoil magnetic susceptibility survey. Some techniques are more suitable than others in particular situations, depending on site-specific factors including the nature of likely targets; depth of likely targets; ground conditions; proximity of buildings, fences or services and the local geology and drift.

5.3 In this instance, based on archaeological desk-based assessment, it was considered possible that cut features such as ditches and pits might be present on the site, and that other types of feature such as salterns, trackways, wall foundations and fired structures (for example kilns and hearths) could also be present.

5.4 Given the anticipated shallowness of targets and the non-igneous geological environment of the study area a geomagnetic technique, fluxgate gradiometry, was considered appropriate for detecting the types of feature mentioned above. This technique involves the use of hand-held magnetometers to detect and record anomalies in the vertical component of the Earth's magnetic field caused by variations in soil magnetic susceptibility or permanent magnetisation; such anomalies can reflect archaeological features.

Field methods

5.5 A 30m grid was established across the survey area and related to the Ordnance Survey (OS) National Grid using a Leica GS15 global navigation satellite system (GNSS) with real-time kinematic (RTK) corrections typically providing 10mm accuracy.

5.6 Measurements of vertical geomagnetic field gradient were determined using Bartington Grad601-2 dual fluxgate gradiometers. A zig-zag traverse scheme was employed and data were logged in 30m grid units. The instrument sensitivity was effectively 0.03nT, the sample interval was 0.25m and the traverse interval was 1m, thus providing 3,600 sample measurements per 30m grid unit.

5.7 Data were downloaded on site into a laptop computer for initial processing and storage and subsequently transferred to a desktop computer for processing, interpretation and archiving.

Data processing

5.8 Geoplot v.3 software was used to process the geophysical data and to produce both a continuous tone greyscale image and a trace plot of the raw (minimally processed) data. The greyscale image and trace plot are presented in Figures 2 and 3; the interpretations are provided in Figures 4 and 5. In the greyscale image, positive magnetic anomalies are displayed as dark grey and negative magnetic anomalies as light grey. A palette bar relates the greyscale intensities to anomaly values in nanoTesla.

5.9 The following basic processing functions have been applied to the geomagnetic data:

clip	clips data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic
zero mean traverse	sets the background mean of each traverse within a grid to zero; for removing striping effects in the traverse direction and removing grid edge discontinuities
de-stagger	corrects for displacement of geomagnetic anomalies caused by alternate zig-zag traverses

interpolate increases the number of data points in a survey to match sample and traverse intervals; in this instance the data have been interpolated to 0.25m x 0.25m intervals

Interpretation: anomaly types

5.10 A colour-coded geophysical interpretation plan is provided. Three types of geomagnetic anomaly have been distinguished in the data:

positive magnetic regions of anomalously high or positive magnetic field gradient, which may be associated with high magnetic susceptibility soil-filled structures such as pits and ditches

negative magnetic regions of anomalously low or negative magnetic field gradient, which may correspond to features of low magnetic susceptibility such as wall footings and other concentrations of sedimentary rock or voids

dipolar magnetic paired positive-negative magnetic anomalies, which typically reflect ferrous or fired materials (including fences and service pipes) and/or fired structures such as kilns or hearths

Interpretation: features

5.11 A colour-coded archaeological interpretation plan is provided.

5.12 Sinuous and dendritic magnetic anomalies have been detected crossing the survey area. These almost certainly reflect infilled water channels, and in some cases are shown on historic OS maps. The variation in magnetic anomalies associated with these former creeks reflects differing fills. The concentration of dipolar magnetic anomalies detected in the south-western of these former creeks almost certainly represents ferrous and/or fired waste materials (such as clinker, slag and brick rubble) used to fill the creek. Other, often much weaker, positive and negative magnetic anomalies reflect soil-filled creeks. In some instances, especially in the central part of the survey area, the edges and course of the former creeks is not clearly defined, which is almost certainly due to the changing course of the creeks over time.

5.13 An approximately 30m wide band of small dipolar geomagnetic anomalies has been detected in the north of the area, on a broadly north-west/south-east alignment. This almost certainly reflects an area of disturbed ground, possibly another much wider water course, or possibly a feature associated with the construction of the adjacent brine reservoirs.

5.14 Very closely spaced, alternate positive and negative magnetic striations have been detected across the survey area, in at least two orientations. The resulting 'texture' in the geomagnetic data almost certainly reflects relatively recent ploughing, perhaps to improve the pasture. Very slight earthwork features were apparent on the ground, evidenced by water collecting in the shallow furrows. In the interests of clarity these anomalies have been omitted from the interpretation drawings.

5.15 The only other anomalies detected here are small, discrete dipolar magnetic anomalies. These almost certainly reflect near-surface items of ferrous and/or fired

debris, such as horseshoes and brick fragments, for example. Strong dipolar magnetic anomalies detected at the south-west edge of the area reflect the adjacent fence or possibly an adjacent buried pipe.

6. Conclusions

6.1 Approximately 4.5ha of detailed geomagnetic survey was undertaken for the SABIC Wetland (South) at Greatham South, Cowpen Marsh, Stockton-on-Tees.

6.2 The courses of former creeks have been identified; these are almost certainly filled with a variety of different materials, including, in some instances, probable clinker, slag or brick rubble. The courses of some of these creeks are shown on mid-20th-century Ordnance Survey maps.

6.3 A wide band of disturbed ground has been detected across the northern part of the area, which may represent a former water channel or possibly ground disturbance associated with the construction of the adjacent reservoirs.

6.4 Plough furrows have been detected across the area.

6.5 No features of likely archaeological significance have been identified in the survey.

7. Sources

Archaeological Services 2017a *Greatham South Flood Alleviation Scheme, Stockton-on-Tees: archaeological works - salterns*. Unpublished interim report **4488**, Archaeological Services Durham University

Archaeological Services 2017b *Greatham South Flood Alleviation Scheme, Stockton-on-Tees: archaeological works – old sea wall.* Unpublished interim report **4493**, Archaeological Services Durham University

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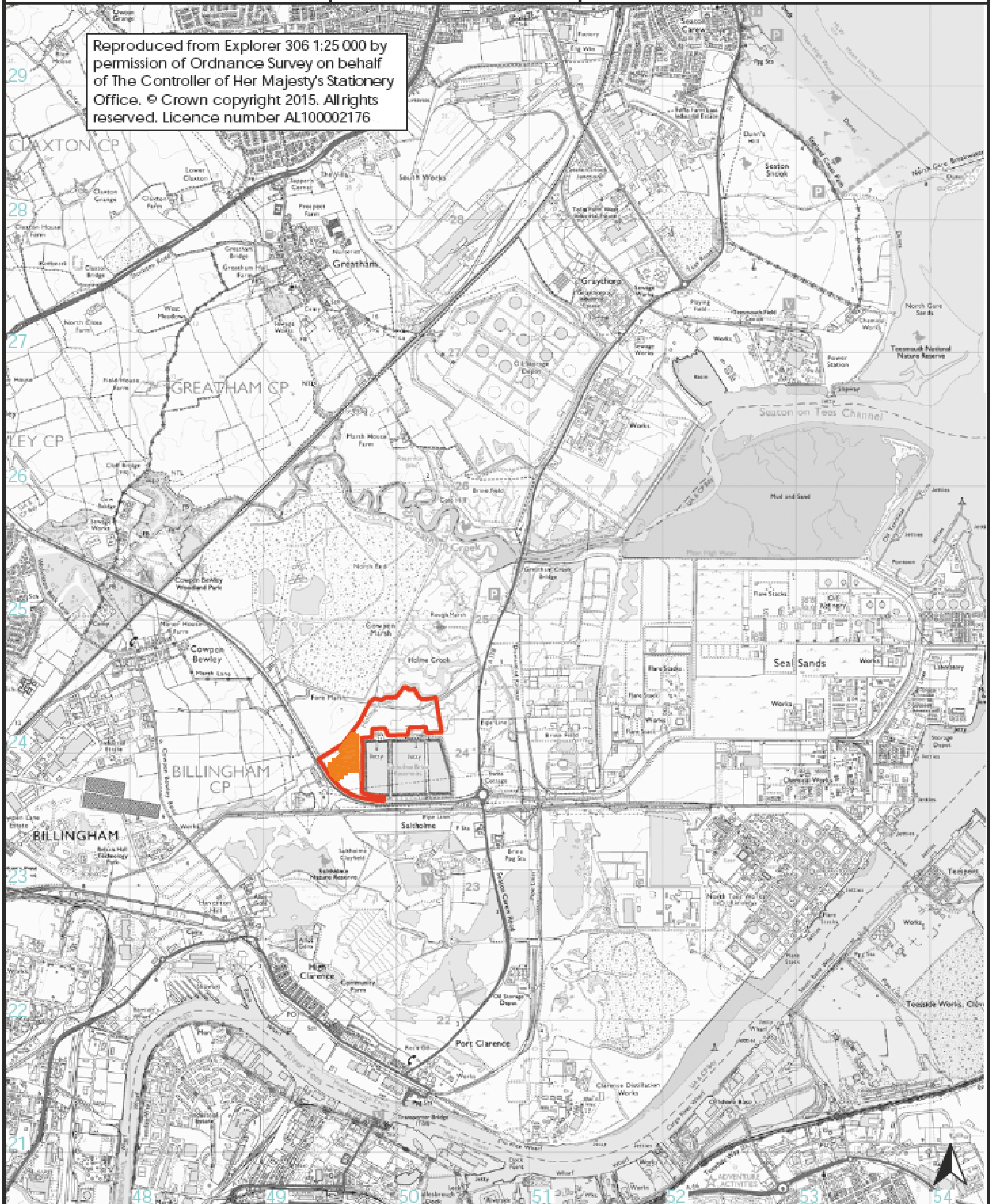
Figure 1: Site location



site location
survey area

0
2km
scale 1:40 000 for A4 plot

magnetic survey

application boundary

study area

-2 nT 3

241

240

239

238

495

496

497

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0 50m

scale 1:1000 for A3 plot

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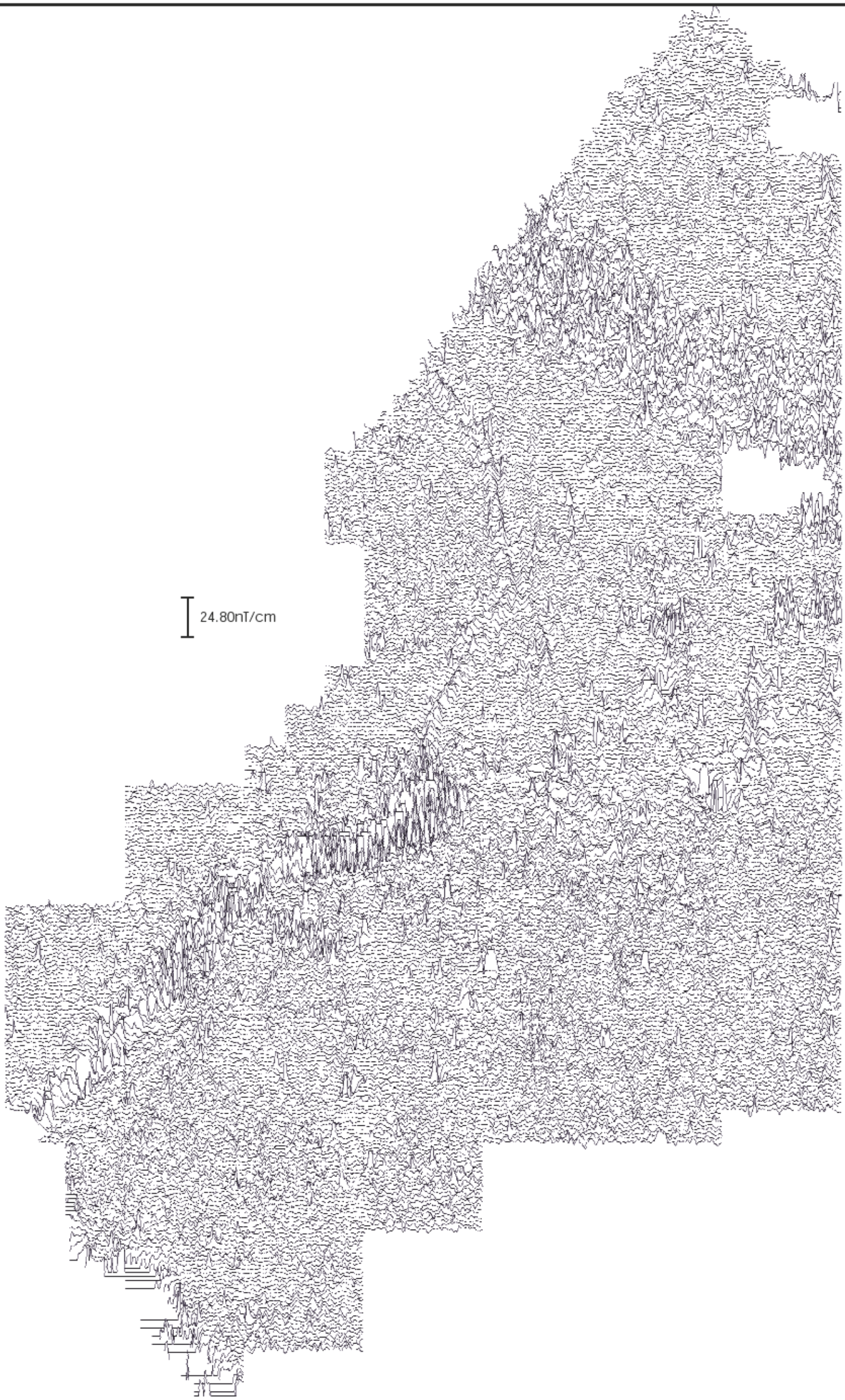
Figure 2: Geophysical survey



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0 50m
scale 1:1000 for A3 plot

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Figure 3: Trace plot of geomagnetic data

magnetic survey

application boundary

study area

dipolar magnetic anomaly

negative magnetic anomaly

positive magnetic anomaly

241

240

239

238

495

496

497

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0 50m
scale 1:1000 for A3 plot

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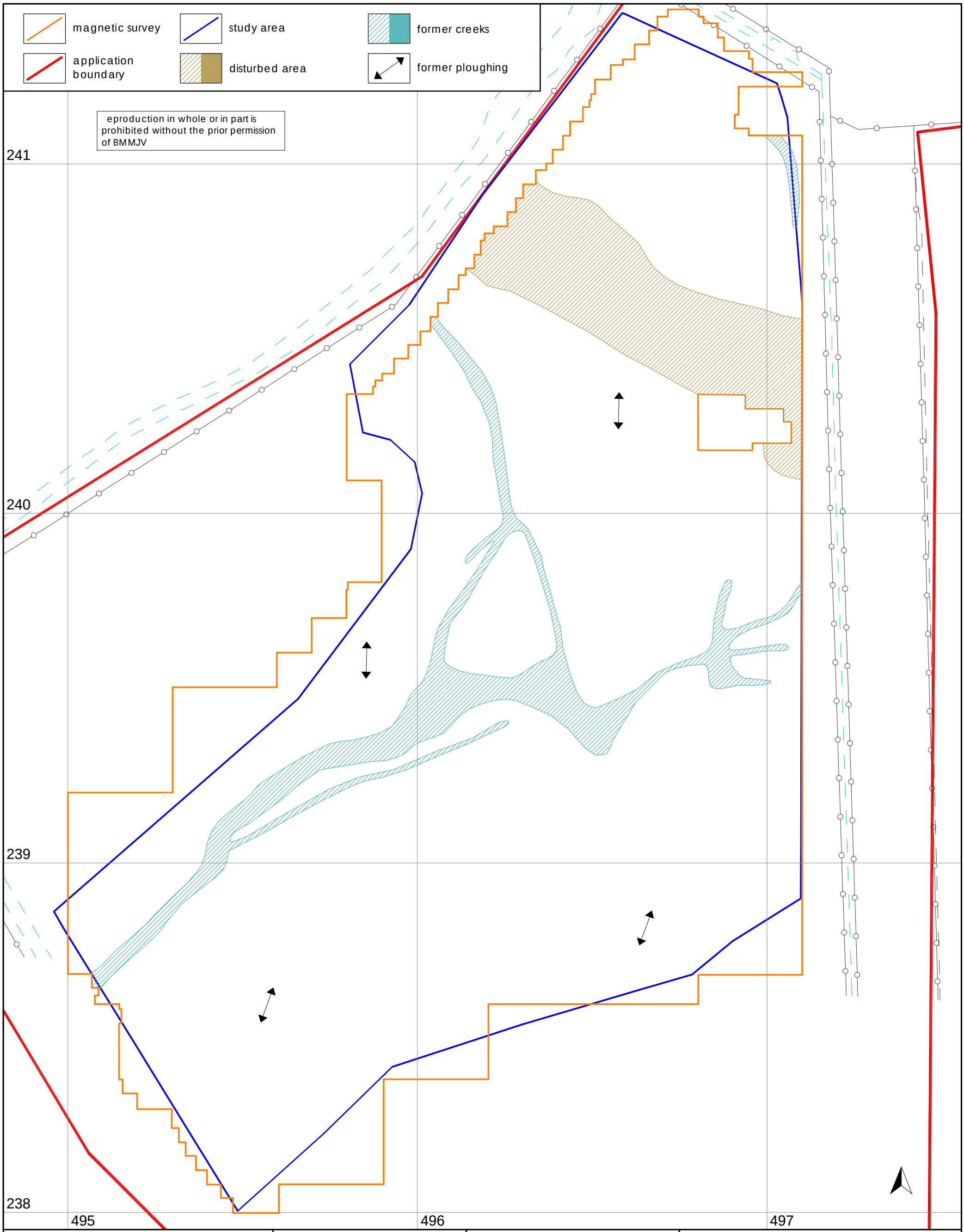
Figure 4: Geophysical interpretation



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0 50m
scale 1 1000 for A3 plot

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