ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
AMEC

J7 A55
Gaerwen
Anglesey

geophysical survey

report 3194
July 2013

Durham University

Contents

Figures

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1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted in advance of possible development of land to the south-west of Junction 7 on the A55 road at Gaerwen, Anglesey. The works comprised detailed geomagnetic survey of 12 areas totalling approximately 17.2ha.

1.2 The works were commissioned by AMEC and conducted by Archaeological Services Durham University.

Results

1.3 A few probable soil-filled features have been identified, which could potentially be archaeological in origin.

1.4 Several strong magnetic anomalies almost certainly reflect geological features. Some of these, aligned north-west/south-east, almost certainly reflect intrusive igneous dykes. A possible lightning discharge point has also been identified.

1.5 The above anomalies have not significantly hindered the detection or identification of weaker anomalies, which can often be associated with archaeological features, except in parts of Areas 2 and 12.

1.6 Features recorded by historic Ordnance Survey editions have been identified, including a former field boundary, pits and a former pond.

1.7 Several land drains and services have also been detected.

2. Project background

Location (Figure 1)

2.1 The study area was located on land to the south-west of Junction 7 on the A55 road at Gaerwen, Anglesey (NGR centre: SH 4887 7212). Twelve surveys totalling approximately 17.2ha were conducted in 12 land parcels. To the north was the A55 road; to the east the A5152 road; to the south the A5 road; and to the west were hedgerows and open farmland, with housing and commercial development of Gaerwen to the south-west.

Development proposal

2.2 The University of Wales, Bangor in partnership with the Isle of Anglesey County Council and Welsh Government propose to develop a state-of-the-art science park in close proximity to the main university campus. Land to the south-west of A55 Junction 7 at Gaerwen is one of three sites in Anglesey under consideration for the development.

Objective

2.3 The specific aim of the geophysical survey was to provide information on the extent and nature of potential archaeological features within the site boundary. The primary objective of the wider project is to collate information on the archaeological interest of the site and to make an assessment of the likely implications of development within the site. This will allow an informed decision to be made on the most suitable site for the science park and inform any further archaeological response to the proposed development.

Methods statement

2.4 The surveys have been undertaken in accordance with a design brief provided by Gwynedd Archaeological Planning Service, a Written Scheme of Investigation provided by AMEC (Appendix) and with national standards and guidance (see para. 5.1 below).

Dates

2.5 Fieldwork was undertaken between 10th-12th June and 16th-18th July 2013. This report was prepared for July 2013.

Personnel

2.6 Fieldwork was conducted by Ashley Hayes, Nathan Thomas (Supervisor), Richie Villis (Supervisor) and Rebekah Watson. The geophysical data were processed by Ashley Hayes and Duncan Hale (the Project Manager). This report was prepared by Richie Villis and Duncan Hale, with illustrations by David Graham and Janine Watson.

Archive/OASIS

2.7 The site code is **AGJ13**, for **A**nglesey **G**aerwen **J**unction 7 A55 20**13**. The survey archive will be supplied on CD to the client for deposition with the project archive in due course.

Acknowledgements

2.8 Archaeological Services Durham University is grateful for the assistance of landowners and tenants in facilitating this scheme of works.

3. Historical and archaeological background

3.1 An archaeological desk-based assessment is being undertaken. No previous detailed archaeological study has been undertaken.

3.2 The site is considered to have a high archaeological potential due to the proximity of the multi-period site Capel Eithin, which is a scheduled monument (An120, *c*. 275m north). Excavations between 1978 and 1981 and previous recorded discoveries identify at least four phases of significant activity. These include Neolithic occupation; an early Bronze Age cremation cemetery; late Iron Age/Roman enclosures and structural evidence, possibly associated with bronze casting; and an extensive early medieval cemetery. A complex, multi-phase archaeological resource is likely to exist beyond the scheduled area of Capel Eithin, and evidence of contemporary archaeological features may exist within the proposed development area.

4. Landuse, topography and geology

4.1 Surveys have been undertaken in 11 fields of pasture and grassland. See table below for details.

Area	Size (ha)	Landuse	Topography & notes	NGR
1	4.34	pasture; cows & sheep	gentle slope north to south; some minor earthworks; wall & ditch to west, wall & trees to north, fence to east & south; A5 to south, A5152 to east	SH 48990 71992
2	1.55	pasture; cows & sheep	flat; wall to south, fence at north, east & south-west; waste/spoil along west edge; metal trailer in west; A5152 to east, A55 to north	SH 49107 72155
3	0.36	pasture; cows & sheep	flat; metal fence at north, east & west, spoil & farmyard to south; A55 to north	SH 49057 72246
4	1.36	pasture; horse, cows & sheep	gentle slope north to south; metal fence at north & east, hedges at south & west; metal barn to south-east; feeder in east; A55 to north	SH 48876 72279
5	0.22	pasture; cows & sheep	flat; hedge at east, fence at north, hedge & fence at south; feeder in east; A55 to north	SH 48751 72332
6	1.85	pasture; sheep	flat, earthwork/mound in north-east; ditch, hedge & fence to west, metal fence to east & north, metal security fence & van park to south-east	SH 48726 72043
7	1.56	pasture; sheep	flat; ditch & hedge at north & west, metal fence at south & east; marsh grasses/bog	SH 48789 72188

8	0.46	ungrazed	flat; metal fence at south & west, hedge & fence at north & east; tall grasses	SH 48885 72150
9	0.56	ungrazed	gentle undulation; metal fence at north & west, hedge & fence at east, spoil, metal container & farmyard to south; nettles, stand pipe, metal waste & feeder in centre; tall grasses	SH 48861 72097
10	0.40	pasture; sheep	flat; metal fence at east & west, paddocks & buildings at north, metal security fence & van park to south	SH 48798 72011
11	0.19	pasture; sheep	flat; metal fences all sides, metal security fence & van park to south	SH 48843 71996
12	4.18	silage/pasture; bull & horses	flat; open ditch along southern boundary, hedge & fence to east, hedge & fence at north; feeder near centre	SH 48646 72236

4.2 The land was predominantly level, sloping gradually down to the south-west with elevations between approximately 60-70m OD.

4.3 The underlying solid geology of the area comprises undifferentiated Neoproterozoic-Cambrian mica schist of the Central Anglesey Shear Zone and Berw Shear Zone, which is overlain by Devensian till.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with English Heritage guidelines, *Geophysical survey in archaeological field evaluation* (David, Linford & Linford 2008); the Institute for Archaeologists (IfA) *Standard and Guidance for archaeological geophysical survey* (2011); the IfA Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service *Guide to Good Practice: Geophysical Data in Archaeology* (Schmidt & Ernenwein 2011).

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 it was considered likely that cut features such as ditches and pits might be present on the site, and that other types of feature such as trackways, wall foundations and fired structures (for example kilns and hearths) might also be present.

5.4 Given the anticipated shallowness of targets and the metamorphic 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 each survey area and related to the Ordnance Survey 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 nominally 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 continuous tone greyscale images and trace plots of the raw (minimally processed) data. The greyscale images and interpretations are presented in Figures 2-5; the trace plots are provided in Figure 6. In the greyscale images, 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 each dataset:

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
destagger	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

General comments

5.11 A colour-coded archaeological interpretation plan is provided.

5.12 Except where stated otherwise in the text below, positive magnetic anomalies are taken to reflect relatively high magnetic susceptibility materials, typically sediments in cut archaeological features (such as ditches or pits) whose magnetic susceptibility has been enhanced by decomposed organic matter or by burning.

5.13 Broad bands of very strong positive and dipolar magnetic anomalies have been detected aligned broadly north-west/south-east across some of the survey areas. These almost certainly reflect geological features rather than anthropogenic features. These anomalies are likely to reflect the thermoremanent magnetism of intrusive igneous dykes. Unnamed igneous intrusions of Ordovician and Palaeogene microgabbro, and unknown age gabbro, microgabbro and diorite, have been recorded on a similar alignment elsewhere in south-east Anglesey, including *c*. 250m east and *c*. 700m west of the study area.

5.14 Small, discrete dipolar magnetic anomalies have been detected in all of the survey areas. These almost certainly reflect items of near-surface ferrous and/or fired debris, such as horseshoes and brick fragments, and in most cases have little or no archaeological significance. A sample of these is shown on the geophysical interpretation plan, however, they have been omitted from the archaeological interpretation plan and the following discussion.

5.15 Except where noted in the following discussion, strong dipolar magnetic anomalies detected at the edges of survey areas correspond to metal field boundaries.

Area 1

5.16 Small clusters of dipolar magnetic anomalies have been detected at the western edge of this area. These correspond to small earthworks of piled stone at the side of the field. The dipolar nature of the magnetic anomalies suggests an igneous component to the natural stone.

5.17 Two broad and strong dipolar magnetic anomalies have has been detected crossing the south of the area, aligned north-west/south-east, continuing to the north-west through Areas 10, 11 and 6. In this instance, these anomalies almost certainly reflect thermoremanent magnetism associated with intrusive igneous dykes.

5.18 A 'starfish-shaped' dipolar magnetic anomaly has been detected near the centre of the area. Whilst these anomalies can reflect other igneous geological components they are typical of lightning-induced remanent magnetism (LIRM). LIRM can create linear, radial and dendritic dipolar magnetic anomalies in all types of geological environments (Jones & Maki 2005). In this instance the anomaly probably marks the site of a lightning discharge.

5.19 A strong 'L-shaped' anomaly has also been detected in this area. It is possible that this also reflects a lightning discharge, but it may also reflect a small igneous intrusion. Some weak negative magnetic anomalies in this area may also reflect geological features.

5.20 A linear dipolar magnetic anomaly has been detected aligned north-east/south-west across the central part of the area. This probably reflects a service or other utility, such as a drainage pipe.

5.21 Two strong linear dipolar magnetic anomalies have been detected crossing the south-east corner of the area. These anomalies are parallel to the access road for Rhoshelyg to the north-east and almost certainly reflect services.

5.22 A very strong dipolar magnetic anomaly been detected on the south-west edge of the survey area, next to the A5 Holyhead Road, reflects an adjacent double-masted road sign.

Area 2

5.23 A number of north-west/south-east aligned strong positive and dipolar magnetic anomalies have been detected in this area. These almost certainly reflect further igneous dykes.

5.24 Several straight, narrow positive and negative magnetic anomalies have been detected in this area. These almost certainly reflect land drains.

5.25 Strong dipolar magnetic anomalies detected along the western edge of the area reflect a metal trailer and other items of ferrous waste and a spoil heap.

Area 3

5.26 Spoilheaps were also present in the south and west of this area.

5.27 Parts of probable igneous dykes have also been detected in this area, continuing across from adjacent areas.

5.28 Occasional straight, narrow positive and negative magnetic anomalies have been detected in this area, which almost certainly reflect further land drains.

Area 4

5.29 The north-west/south-east aligned strong dipolar magnetic anomalies detected in the north-east of the area almost certainly reflect continuations of the igneous dykes detected to the south-east.

5.30 A north-west/south-east aligned chain of small dipolar magnetic anomalies has been detected across the north-east of the area. This corresponds to the location of a former field boundary as shown on early OS editions.

5.31 A very weak and discontinuous curvilinear positive magnetic anomaly has been detected in the east of the area. This could possibly reflect the remains of a ditch.

5.32 A series of parallel weak positive magnetic anomalies has been detected across the survey area, especially in the north-west corner. These probably reflect a former plough regime.

5.33 The very strong dipolar magnetic anomaly detected at the south-east corner of the area reflects the large metal barn on the edge of the area. A strong discrete dipolar magnetic anomaly to the east of this reflects a metal animal feeder.

Area 5

5.34 A large, strong dipolar magnetic anomaly detected in the north-east corner of this area corresponds to a metal animal feeder.

Area 6

5.35 The probable igneous dykes detected in Areas 1, 10 and 11 continue across this area. A smaller, 'Y-shaped' dipolar magnetic anomaly has been detected to the south of the dykes, which probably reflects another geological feature.

5.36 A north-east/south-west aligned chain of dipolar magnetic anomalies has been detected across the centre of the field. This may reflect a former field boundary, but it is not depicted on any OS editions. An alternative interpretation is that the small dipolar anomalies reflect metal collars joining lengths of plastic pipe.

5.37 Weak positive magnetic anomalies aligned parallel to the existing field boundaries probably reflect former ploughing of this area.

5.38 A concentration of dipolar magnetic anomalies has been detected in the north-east corner of the area. This corresponds to a mound with a stone component noted on the ground, and which also corresponds to a feature noted on historic OS editions.

5.39 The very strong dipolar magnetic anomaly detected around the south-east corner of the field reflects a large metal security fence and a number of parked vans in the adjacent service yard.

Area 7

5.40 A north-west/south-east aligned dipolar magnetic anomaly has been detected. This almost certainly reflects a pipe, probably a drainage pipe associated with the boggy ground in the east of the field.

5.41 A strong dipolar magnetic anomaly detected at the mid-point of the east edge of the area reflects a metal gate.

Area 8

5.42 A strong dipolar magnetic anomaly detected at the south-western corner of the area reflects a metal gate.

5.43 A very weak positive magnetic anomaly, aligned north-west/south-east, has been detected in this area. This could possibly reflect the heavily truncated remains of a ploughed-out soil-filled ditch feature.

Area 9

5.44 A concentration of both large and small intense dipolar magnetic anomalies has been detected in the centre of this area, almost certainly indicating ferrous/fired materials. A number of large ferrous and fired items, including a brick water trough and rolled up mesh wire fencing, were present on the ground. The concentration of smaller anomalies almost certainly reflects materials in the backfill of a former pond, as shown on previous OS editions.

5.45 A linear positive magnetic anomaly has been detected in the west of the area. This could reflect an older soil-filled ditch feature or a more recent drainage ditch.

Areas 10 & 11

5.46 North-west/south-east aligned strong positive and dipolar magnetic anomalies have been detected in these areas. These almost certainly reflect intrusive igneous dykes, as also detected in the fields to either side.

5.47 The very strong dipolar magnetic anomaly detected on the southern side of these areas reflects the large metal security fence and parked vans in the service area to the south.

Area 12

5.48 North-west/south-east aligned strong positive and dipolar magnetic anomalies have been detected across this area. These anomalies almost certainly reflect intrusive igneous dykes, as also detected continuing across the fields to the south-east.

5.49 Two concentrations of small, strong dipolar magnetic anomalies, which were detected in the centre and east of this area, almost certainly reflect ferrous/fired materials. The anomalies almost certainly reflect the backfill of former pits or hollows shown on early OS editions. These features could have been former quarry pits, since similar features are recorded as such in nearby fields. A third similar cluster of anomalies was detected between the two described above. Although this one is not shown on early OS maps it could also be a former pit, now infilled.

5.50 An intense magnetic anomaly aligned north-east/south-west appears to continue into Area 5 in the north and is similar in character to others detected in Areas 1 and 7. These anomalies are interpreted as services, perhaps wire-strengthened water supply hoses for troughs. Each of these could have run along a former field boundary. Although these boundaries are not shown on any OS maps they could predate the first edition OS. The one in this area is aligned with an existing boundary to the south.

5.51 A series of parallel, alternate, positive and negative magnetic anomalies has been detected across the central part of the field, aligned with the probable former boundary and the existing eastern boundary. These anomalies probably reflect a former plough regime.

6. Conclusions

6.1 Detailed geomagnetic surveys were undertaken on land to the south-west of Junction 7 on the A55 road at Gaerwen, Anglesey, to assess the archaeological potential of the site and inform a decision on the proposed development of a science park.

6.2 A few probable soil-filled features have been identified, which could potentially be archaeological in origin.

6.3 Several strong magnetic anomalies almost certainly reflect geological features. Some of these, aligned north-west/south-east, almost certainly reflect intrusive igneous dykes. A possible lightning discharge point has also been identified.

6.4 The above anomalies have not significantly hindered the detection or identification of weaker anomalies, which can often be associated with archaeological features, except in parts of Areas 2 and 12.

6.5 Features recorded by historic OS editions have been identified, including a former field boundary, pits and a former pond.

6.6 Several land drains and services have also been detected.

7. Sources

David, A, Linford, N, & Linford, P, 2008 *Geophysical Survey in Archaeological Field Evaluation*. English Heritage

Gaffney, C, Gater, J, & Ovenden, S, 2002 *The use of geophysical techniques in archaeological evaluations*. Technical Paper **6**, Institute of Field Archaeologists

IfA 2011 *Standard and Guidance for archaeological geophysical survey*. Institute for Archaeologists

Jones, G, & Maki, D, 2005 Lightning-induced Magnetic Anomalies on Archaeological Sites. *Archaeol. Prospect.* **12**, 191-197

Schmidt, A, & Ernenwein, E, 2011 *Guide to Good Practice: Geophysical Data in Archaeology*. Archaeology Data Service

Appendix: Project Written Scheme of Investigation

J7 A55, Gaerwen: Archaeological Written Scheme of Investigation

Introduction

1.1 Summary

1.1.1 The site is one of three within Anglesey which are being considered for a science park development. An archaeological assessment is being undertaken in order to assess the archaeological implications of development at each of the sites and to inform the decision over the most suitable site. The assessment will involve desk-based assessment and geophysical survey.

1.2 Project Background

1.2.1 The University of Wales, Bangor (UWB) in partnership with the Anglesey County Council (IoCC) and Welsh Government (WG) wishes to develop a state-of-the-art science park in close proximity to the main university campus.

1.2.2 There are three sites within Anglesey which are under consideration for development as the science park and these are:

- Lledwigan, Llangefni (245490, 374150);
- J7 A55, Gaerwen (249220, 372350); and
- Ty Mawr, Llanfairpwll (253710, 372400).

1.2.3 The project will involve the completion of archaeological survey and assessment in order to provide information on the archaeological interests of each of the sites included in the study. This information will be used in determining which of the sites may be the most deliverable as a science park and to this end it has been determined that for each site the available information will include:

- Desk-based Assessment; and
- Geophysical Survey.

1.2.4 This written scheme has been prepared in response to a design brief issued by Gwynedd Archaeological Planning Service and sets out detail on the work to be undertaken, together with timetable and staffing details.

1.3 Planning Background

1.3.1 Policy guidance on how cultural heritage should be treated in Wales is given in Chapter 6 of Planning Policy Wales (PPW) (Edition 5 - November 2012). This states the Welsh Assembly's objectives to '*…preserve or enhance the historic environment…*', to '*…protect archaeological remains, which are a finite and non-renewable resource…*' and to ensure the protection of historic buildings and conservation areas.

1.3.2 Further advice on planning and archaeology is given in Welsh Office (W.O.) Circular 60/96: Planning and the Historic Environment: Archaeology.

1.3.3 With regard to archaeological sites the Ynys Môn Local Plan (1996) includes Policy 39, which states that provision will be made for the protection of scheduled monuments and other sites of archaeological interest. However, where development proposals affect other unscheduled archaeological remains which do not merit preservation, provision will be made for an appropriate archaeological response.

2. Site Location and Ground Conditions

2.1.1 The site is located to the immediate northeast of Gaerwen. It is bordered to the north by the A55, to the east by the A5152, to the south by the A5 Holyhead Road, and the modern residential developments along it and to the east by agricultural land. The site is irregular in shape and extends approximately 21ha. The site comprises approximately 9 parcels of land of varying sizes, mainly characterised by improved pasture and arable grassland. It includes the farm Cefn-du and a pair of modern houses. The internal boundaries include stone wall, hedgerows and fencing. It is relatively level, sloping gradually south-westwards from around 70m to 60m OD.

2.1.2 The British Geological Survey (BGS) records the solid (bedrock) geology underlying the site as comprising the Central Anglesey Shear Zone and Berw Shear Zone Mica Schist, with superficial geology of boulder clay.

3. Objectives and Research Design

3.1.1 The primary objective of the project will be to collate information on the archaeological interest of the site and to make an assessment of the likely implications of development within the site. This will allow an informed decision to be made on the most suitable site for the science park and inform any further archaeological response to the proposed development.

3.1.2 In particular, it has been noted that the nearby multi-period site known as Capel Eithin (SM A120) demonstrates evidence for occupation during the Neolithic, Bronze Age, late Iron Age/Romano-British and early Medieval periods with various settlement, industrial and funerary activities. It is intended that the assessment will provide further information on the extent to which associated remains may extend to within the site boundary.

3.1.3 The aim of the desk-based assessment will be to identify and characterise the historic environment (archaeological and built heritage) resource within the site and surrounding study area, in order to provide an archaeological and historical baseline for the proposed development. It will aim to:

- Identify all recorded and designated heritage assets within the study area;
- Assess the potential for previously unrecorded archaeological remains within the site;
- Identify and describe designated and undesignated built heritage assets within the site and study area;
- Identify and describe historic landscape features within the site and study area; and
- Assess the potential impacts of the proposed works on known or suspected heritage assets.

3.1.4 The geophysical survey will be completed as a non-intrusive survey method aimed at providing information on the extent and nature of potential cut archaeological features within the site boundary.

4. Assessment Methodology

4.1 Stage 1: Desk-based Assessment

4.1.1 The desk-based assessment will involve the collection of information in order to develop an understanding of the history of the site and a deposit model of potential archaeological remains within the site.

4.1.2 This will involve a review of all relevant and available sources in order to provide information on the archaeological interests of the site and to inform all further work. As a minimum, this will include a review of:

- Databases of existing records of archaeological remains;
- Records of designated assets (e.g. scheduled monuments, listed buildings etc)
- Aerial photographs;
- Historic maps;
- Published sources;
- Records of previous archaeological investigations; and
- Geotechnical data.

4.1.3 These will be obtained from the following sources, where required.

- Gwynedd Archaeological Planning Service (Historic Environment Record);
- Cadw;
- Royal Commission on Ancient and Historical Monuments in Wales (RCAHMW), Aberystwyth;
- National Library of Wales, Aberystwyth;
- Anglesey Archives, Llangefni; and
- University College, Bangor.

4.1.4 Data will be collected for a study area extending 1 km from the site boundary.

4.1.5 A site walkover will also be undertaken in order to review the current conditions and to record the presence, nature and extent of any visible features of archaeological interest.

4.1.6 The results of the desk-based assessment will be presented in a report. As a minimum, this will include:

- Project and Planning Background;
- Site Description;
- A history of the site;
- Archaeological deposit model, setting out the potential survival of archaeological remains; and
- Conclusions and Recommendations.

The reports will set the findings in the local archaeological and planning policy context, and will be supported by maps, plans and photographs as required.

4.2 Stage 2: Geophysical Survey

Technique selection

4.2.1 Geophysical surveying enables the relatively rapid and non-invasive identification of potential archaeological features and can involve a variety of complementary techniques such as magnetometry, electrical resistivity, ground-penetrating radar and electromagnetic survey.

4.2.2 Some techniques are more suitable than others in particular situations, depending on a variety of 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.

4.2.3 In this instance, it is considered likely that cut features such as ditches and pits could be present on the site, and that other types of feature such as trackways, fired structures (for example kilns and hearths) could also be present. The geology includes boulder clay.

4.2.4 Given the anticipated nature and depth of targets and the local geology it is considered that geomagnetic survey (fluxgate gradiometry) is the most appropriate technique in this instance. Fluxgate gradiometry involves the use of hand-held magnetometers to detect and record anomalies in the vertical component of the Earth's magnetic field which are caused by variations in soil magnetic susceptibility or permanent magnetisation; such anomalies can reflect, for example, ferrous, stone, brick and soil-filled features.

Fieldwork

4.2.5 A 30m survey grid will be established and recorded using a Leica GS15 global navigation satellite system (GNSS) with real-time kinematic (RTK) correction typically providing accuracy of 10mm.

4.2.6 Measurements of vertical geomagnetic field gradient will be determined using Bartington Grad601-2 fluxgate gradiometers. A zig-zag traverse scheme will be employed and data logged in 30m grid units. The sample interval will be set to 0.25m and the traverse interval to 1m, thus providing 3,600 measurements per 30m grid unit.

4.2.7 Data will be downloaded on site into a laptop computer for verification, initial processing and storage and subsequently transferred to a desktop computer for further processing, interpretation and archiving. Geoplot software will be used to process and interpolate the geomagnetic data to form arrays of regularly-spaced values at 0.25m intervals and to produce continuous-tone greyscale images and trace plots of the raw (unfiltered) data. Plots of filtered data will be provided if appropriate.

Reporting

4.2.8 Interim reports will be provided at the end of the fieldwork phase. Following this a full report will be prepared.

4.2.9 The greyscales will be presented by importing the images directly into digital plans of the area. Palette bars relating the greyscale/trace intensities to anomaly values in nanoTesla will be included with each image. Other types of plots may also be provided, if they aid presentation or interpretation.

4.2.10 Colour-coded geophysical and archaeological interpretation plans will be provided. The survey report will also include a detailed discussion and interpretation, explaining the likely nature of the anomalies, along with their implications. Modern services and other potential hazards will be clearly distinguished.

4.2.11 The report will be based on the following format:

- Executive summary
  - The project
  - Results
- Project background
  - Location
  - Objective
  - Dates
  - Personnel

- Acknowledgements
- Archive

- Archaeological and historical background
- Landuse, topography and geology
- Geophysical surveys
  - Technique selection
  - Field methods
  - Data processing
  - Interpretation: anomaly types
  - Interpretation: features
- Conclusions
- References
- Appendices: Trace plots of geophysical data

5. Timetable

5.1 Desk-Based Assessment

5.1.1 The desk-based assessment will commence with data searches, with a site visit to be undertaken by 14 June 2013. The report will be produced by 21 June 2013.

5.1.2 The geophysical survey fieldwork will be undertaken during 10-21 June 2013 with completion of the report by 5 July.

6. Publication and Archiving

6.1 Publication

6.1.1 All reports will be produced as bound reports as well as pdfs. A minimum of two bound copies of each report will be submitted to GAPS.

6.2 Archiving

6.2.1 A full archive including plans, photographs, written material and any other material resulting from the project will be prepared in accordance with standard guidance. This will be lodged in an appropriate place within six months of the completion of the project. The location of the archive will be agreed with Gwynedd Archaeological Planning Service, but it is anticipated that this may be Oriel Ynys Mon Museum, Rhosmeirch.

6.2.2 Due to the nature of the works, no artefacts are expected to be recovered

7. Other Matters

7.1 Staffing

Project Management

7.1.1 Simon Atkinson MIFA will be project manager will overall responsibility for completion of the project. Simon is a Principal Consultant within AMEC with twenty four years of professional experience in the historic environment sector.

Desk-Based Assessment

7.1.2 The des-based assessment will be undertaken by Fay Bowen, who has recently joined AMEC as a Consultant, with previous experience of working with the Glamorgan-Gwent Archaeological Trust.

Geophysical Survey

7.1.3 The Geo-physical survey will be undertaken by Archaeological Services Durham University. Duncan Hale BA MIfA (Senior Archaeologist) will be responsible for completion of the survey, supported by survey and technical staff as required.

7.2 Health and Safety

7.2.1 All work will be subject to health and safety restrictions and the requirements of the Health and Safety at Work Act 1974. Details contained in AMEC's Project Health and Safety Plan will be in operation during assessment and survey works. This will be revised to cover any project specific requirements which may arise during completion of the project.

7.2.2 The site is currently in agricultural use and no specific risk are expected, other than general risks associated with travel and site visits (e.g, livestock, uneven ground, presence of water-bodies).

7.3 Curatorial Monitoring

7.3.1 Curatorial responsibility for the project lies with the Gwynedd Archaeological Planning Service (GAPS). It is not anticipated that GAPS will need to monitor works on site, although access will be made available if so and notification will be given of survey dates to allow monitoring.

7.3.2 Information provided in this document cannot fully anticipate the conditions that will be encountered as work progresses. Any alteration or amendment to the scope of work, details of the programme and staff proposed to undertake the work will be notified to GAPS.

Author: Simon Atkinson *Reviewer:* Robert Johns

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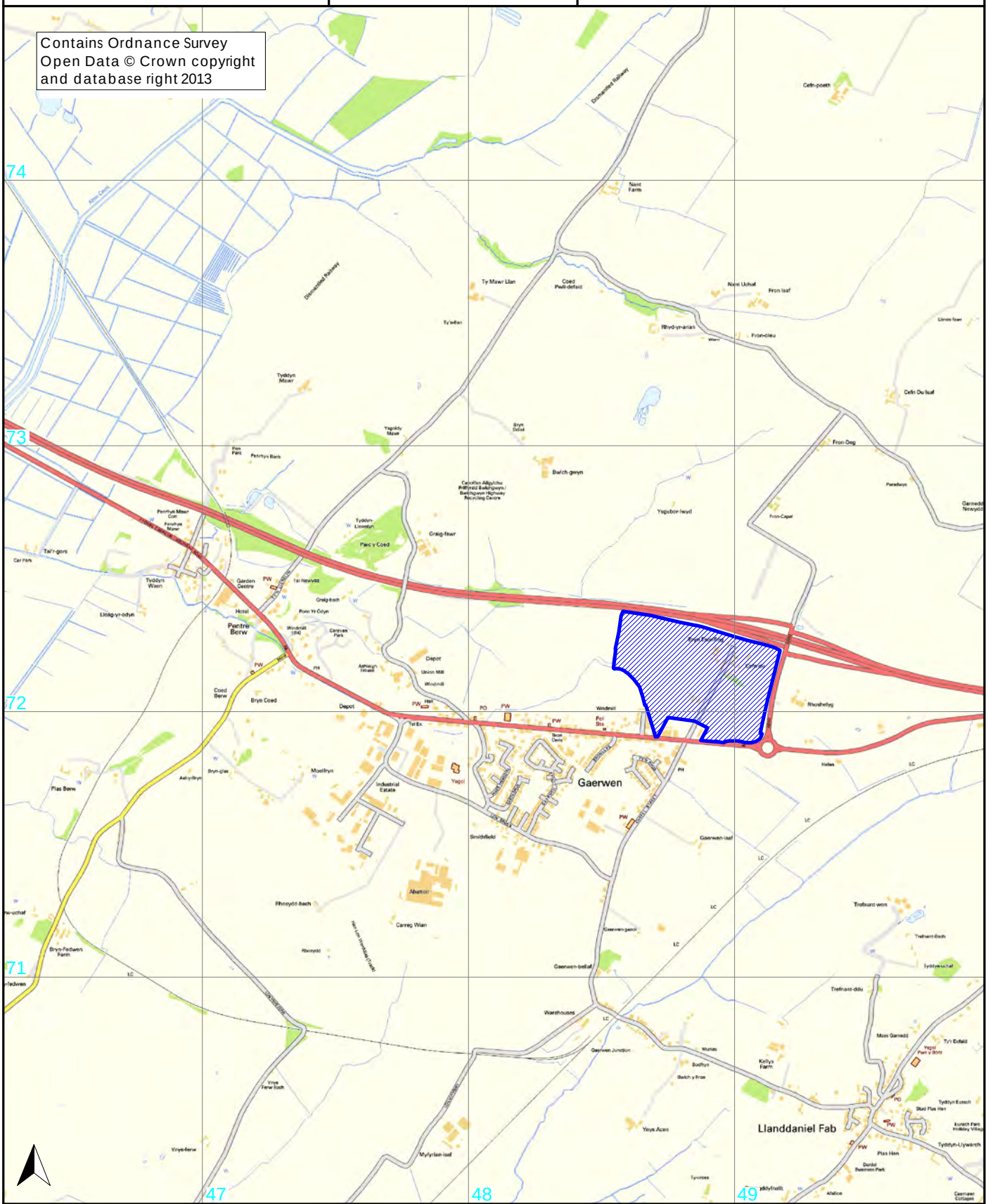
Figure 1: Site location



site location

0 1km
scale 1:20 000 for A4 plot

Area 5
A55
Area 4
Area 3
Area 12
Area 7
Area 8
Area 2
A5152
Area 9
Area 6
Area 10
Area 11
A5 - Holyhead Road
Area 1
GAERWEN
Chapel Street
724
723
722
721
720
719
718
485
486
487
488
489
490
491
492

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Figure 2: Geophysical survey overview

0 100m
scale 1:2500 for A3 plot

site boundary
magnetic survey
-6 nT 8

Area 5

A55

Area 4

Area 3

Area 12

Area 7

Area 8

Area 2

A5152

Area 9

Area 6

Area 10

Area 11

A5 - Holyhead Road

Area 1

GAERWEN

724
723
722
721
720
719

485
486
487
488
489
490
491
492

site boundary

magnetic survey

-6 nT 8

0 50m

scale 1:1000 for A1 plot

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Figure 3: Geophysical survey

Area 5

A55

Area 4

Area 3

Area 12

Area 7

Area 8

Area 2

A5152

Area 9

Area 6

Area 10

Area 11

A5 - Holyhead Road

Area 1

GAERWEN

724
723
722
721
720
719

485
486
487
488
489
490
491
492

site boundary
magnetic survey
dipolar magnetic anomaly
positive magnetic anomaly
negative magnetic anomaly

0 50m
scale 1:1000 for A1 plot

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Figure 4: Geophysical interpretation

724
723
722
721
720
719

485 486 487 488 489 490 491 492

A55

A5152

A5 - Holyhead Road

GAERWEN

Area 1
Area 2
Area 3
Area 4
Area 5
Area 6
Area 7
Area 8
Area 9
Area 10
Area 11
Area 12

feeder
feeder
feeder
trailer
infilled pond
spoilheap
metal container
mound

site boundary
magnetic survey
soil-filled feature
disturbed area
geological feature
service pipe
former ploughing
land drain
former field boundary

0 50m
scale 1:1000 for A1 plot

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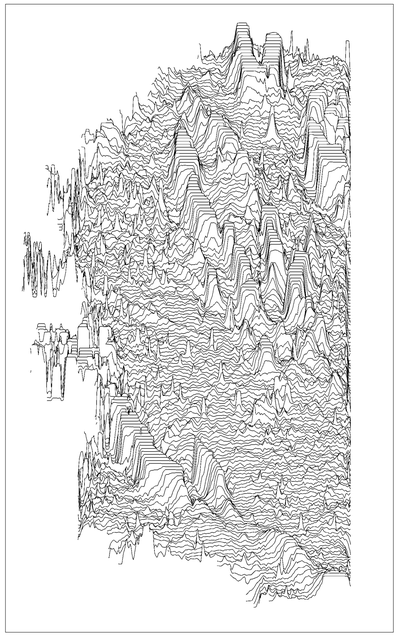
Figure 5: Archaeological interpretation

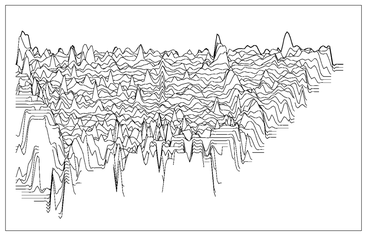
Area 1

32.00nT/cm



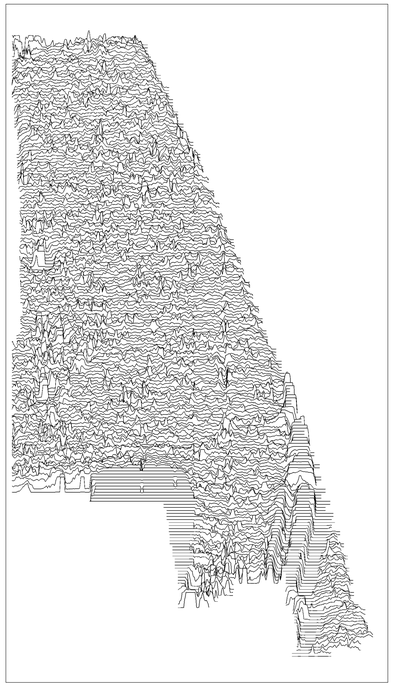
Area 2

28.00nT/cm



Area 3

40.00nT/cm

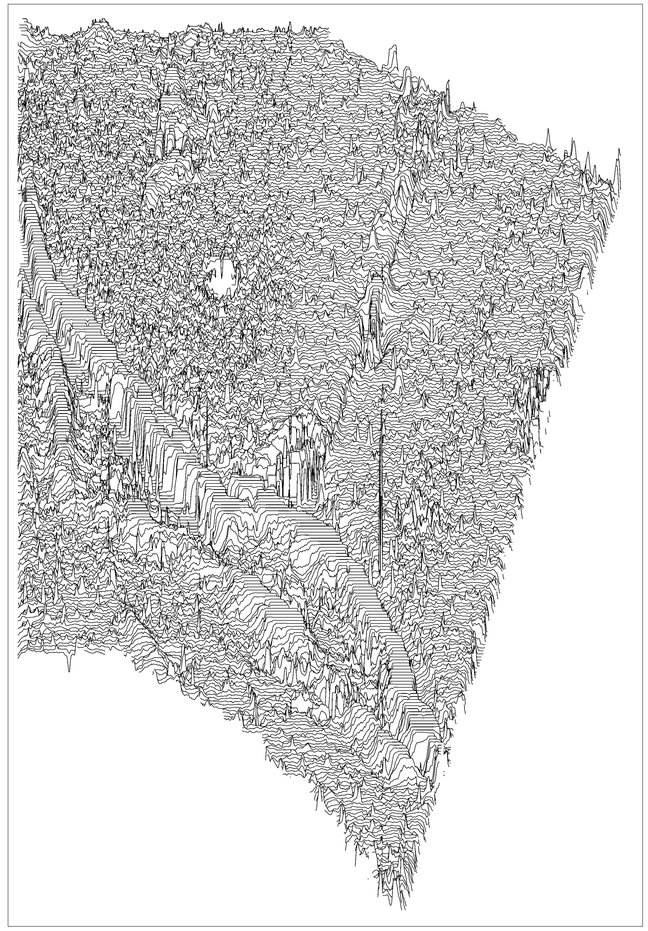


Area 4

80.00nT/cm

Area 5

36.00nT/cm

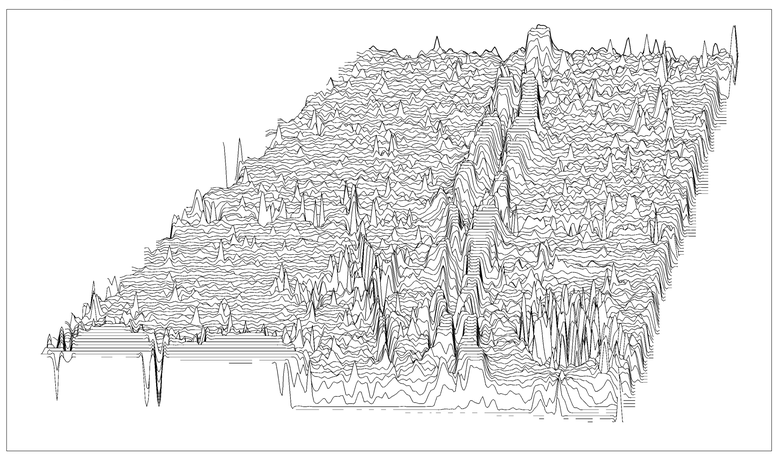


Area 12

30.70nT/cm

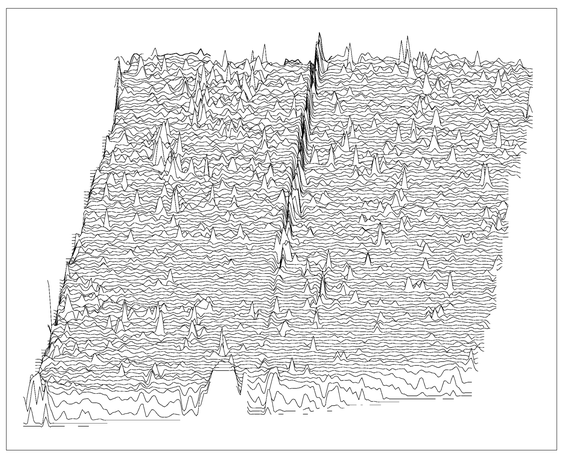
Area 6

28.00nT/cm



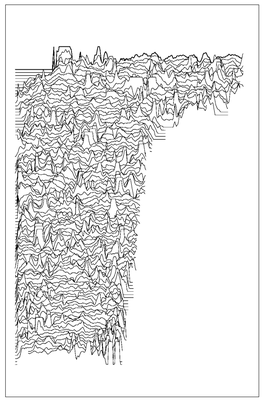
Area 7

28.00nT/cm



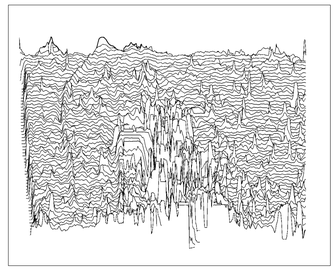
Area 8

8.00nT/cm



Area 9

20.00nT/cm



Area 10

28.00nT/cm

Area 11

28.00nT/cm

0 50m

scale 1:1000 for A1 plot

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Figure 6: Trace plots of geomagnetic data