

LAND ADJACENT TO BRYNHEULOG, ST CLEARS, CARMARTHENSHIRE: GEOPHYSICAL SURVEY



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**LAND ADJACENT TO
BRYNHEULOG, ST CLEARS,
CARMARTHENSHIRE:
GEOPHYSICAL SURVEY**

By

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**LAND ADJACENT TO BRYNHEULOG, ST CLEARS, CARMARTHENSHIRE:
GEOPHYSICAL SURVEY**

EXECUTIVE SUMMARY

DAT Archaeological Services were commissioned to undertake a geophysical survey on land adjacent to Brynheulog, St Clears, Carmarthenshire, on land proposed for residential development.

Bronze Age round barrows have been previously recorded in the vicinity. The purpose of the survey was to provide a better indication of the archaeological potential of the site and if required, to enable targeting of further archaeological mitigation before or during the proposed development.

No evidence of positive archaeological remains were detected, but two features of potential archaeological interest were identified, and some potential for undetected Bronze Age archaeology remains.

CRYNODEB GWEITHREDOL

Comisiynwyd Gwasanaethau Archeolegol YAD i gynnal arolwg geoffisegol ar dir ger Brynheulog, Sanclêr, Sir Gaerfyrddin, ar dir arfaethedig ar gyfer datblygiad preswyl.

Mae crugiaau crwn o'r Oes Efydd wedi'u cofnodi o'r blaen yn y cyffiniau. Pwrpas yr arolwg oedd rhoi gwell arwydd o botensial archeolegol y safle ac, os oedd angen, i alluogi targedu lliniaru archeolegol pellach cyn neu yn ystod y datblygiad arfaethedig.

Ni chanfuwyd unrhyw dystiolaeth o olion archeolegol positif, ond nodwyd dwy nodwedd o ddiddordeb archeolegol posibl, ac rhai potensial ar gyfer archeoleg heb ei ganfod o'r Oes Efydd.

1. INTRODUCTION

1.1 Project Commission

- 1.1.1 DAT Archaeological Services were commissioned by Obsidian Developments Ltd to undertake a geophysical survey on land west of Brynheulog, St Clears, Carmarthenshire (centred on NGR SN 2775 1602; Figure 1). The development area comprises two enclosed fields currently laid to grass covering an area approximately 2.39ha. It is proposed the site is developed for 66 residential dwellings.
- 1.1.2 During scoping consultation in 2019 The Development Management section of Dyfed Archaeological Trust (DAT-DM), in their capacity as archaeological advisors to the planning authority, reiterated their recommendation that the site should be archaeologically evaluated prior to determination through a phased scheme of investigation, commencing with a geophysical survey.
- 1.1.3 DAT-DM considered that features/deposits of prehistoric date could potentially extend into the development areas, as there are two Bronze Age barrows (PRNs 3878 and 3879) recorded near the southwest boundary of the development site (See Figure 1). The well-preserved remains of one of the barrows (PRN 3878) has been designated as a Scheduled Monument (SM No. CM332). The second barrow (PRN 3879) was identified from historical references and aerial photography but does not appear to survive as a visible earthwork.
- 1.1.4 This report presents the results of the geophysical survey as the first stage of evaluating the site. The results of this survey will inform whether targeted evaluation of the area is necessary.
- 1.1.5 The results of the geophysical survey should provide further information of the archaeological potential of the site through identification of subsurface features which could be indicative of archaeology.
- 1.1.6 The geophysical survey was undertaken using a fluxgate gradiometer which detects subtle variations in the earth's magnetic field, which can indicate the presence of buried features such as ditches, pits, walls or postholes, which are not visible on the ground surface.

1.2. Scope of the Project

- 1.2.1 The aim of the project was:
 - To identify the presence/absence of any potential archaeological deposits through an initial gradiometer survey.
 - To establish the character and extent of any potential archaeological remains within the site area that could be affected by the proposed works.
 - To prepare a report and archive on the results of the geophysical survey.

1.3 Report Outline

- 1.3.1 This report provides a summary and discussion of the geophysical survey and its results and puts those results within their regional and national context.

1.4 Abbreviations

- 1.4.1 Sites recorded on the regional Historic Environment Record (HER) are identified by their Primary Record Number (PRN) and located by their National Grid Reference (NGR). Sites recorded on the National Monument

Record (NMR) held by the Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW) are identified by their National Primary Record Number (NPRN). Altitude is expressed to Ordnance Datum (OD). References to cartographic and documentary evidence and published sources will be given in brackets throughout the text, with full details listed in the sources section at the rear of the report.

1.5 Illustrations

- 1.5.1 Printed map extracts are not necessarily produced to their original scale.

1.6 Timeline

- 1.6.1 The following timeline (Table 1) is used within this report to give date ranges for the various archaeological periods that may be mentioned within the text.

Table 1: Archaeological and Historical Timeline for Wales

Period	Approximate date	
Palaeolithic –	c.450,000 – 10,000 BC	Prehistoric
Mesolithic –	c. 10,000 – 4400 BC	
Neolithic –	c.4400 – 2300 BC	
Bronze Age –	c.2300 – 700 BC	
Iron Age –	c.700 BC – AD 43	
Roman (Romano-British) Period –	AD 43 – c. AD 410	Historic
Post-Roman / Early Medieval Period –	c. AD 410 – AD 1086	
Medieval Period –	1086 – 1536	
Post-Medieval Period ¹ –	1536 – 1750	
Industrial Period –	1750 – 1899	
Modern –	20 th century onwards	

¹ The post-medieval and industrial periods are combined as the post-medieval period on the Regional Historic Environment Record as held by Dyfed Archaeological Trust

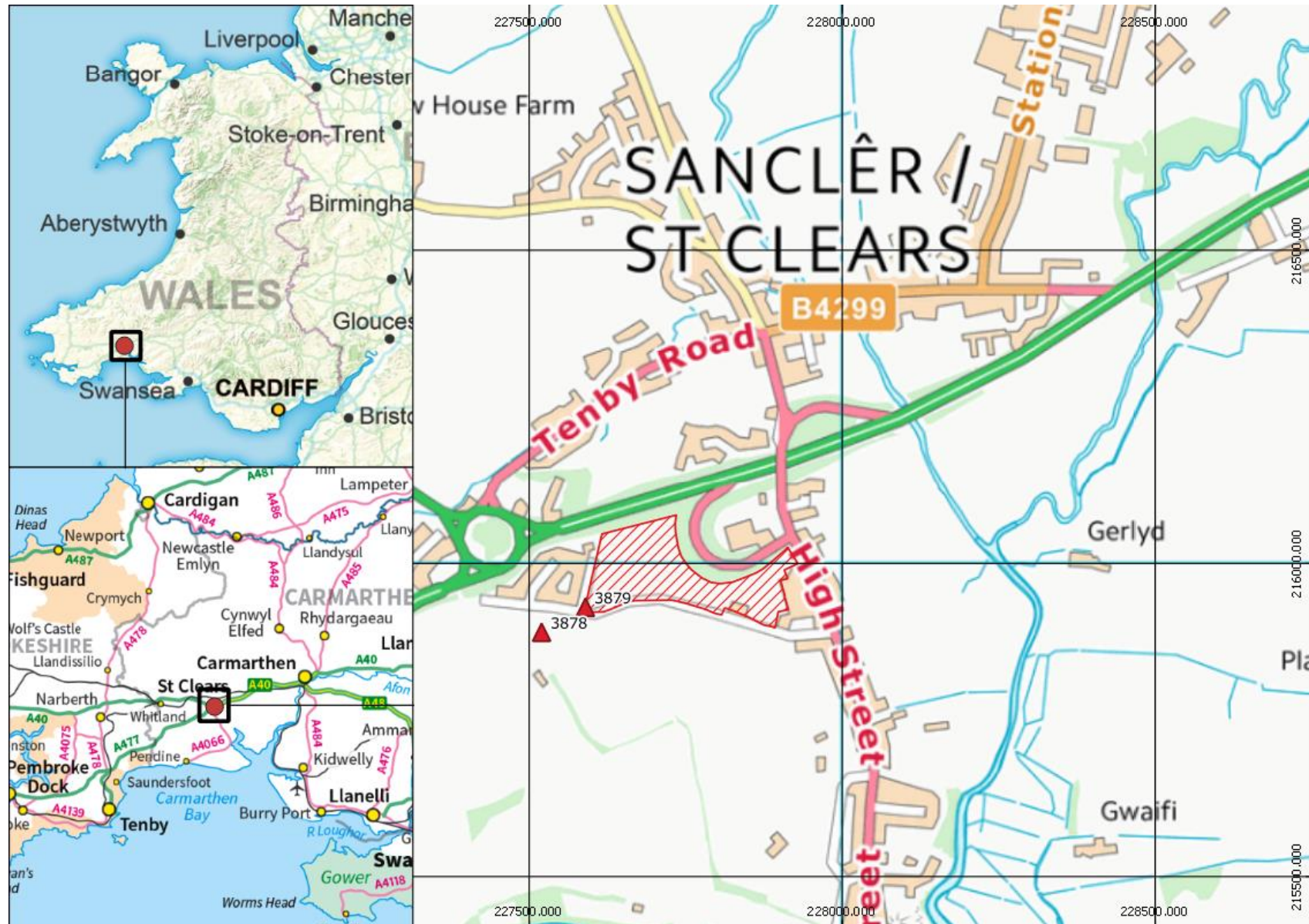


Figure 1: Site location – Development site shown by red hachure and Bronze Age barrows shown by red triangles.

2. THE SITE

2.1 Site Location and Topography

- 2.1.1 The proposed development is situated on land west of Brynheulog, St Clears, Carmarthenshire. The development comprises two enclosed fields (Photos 1 and 2) currently laid to grass, covering an area approximately 2.39ha in size at a height of approximately 30mOD.
- 2.1.2 At the time of the survey four exposed manhole covers were observed, the location of each was recorded as follows:
- Manhole 1: E227628.437 N215992.887
 - Manhole 2: E227675.711 N215988.842
 - Manhole 3: E227688.603 N216011.778
 - Manhole 4: E227778.321 N215967.393
- 2.1.3 The underlying bedrock geology consists of Didymograptus Bifidus Beds – Mudstone. This is a sedimentary rock formed approximately 461 – 466 million years ago in the Ordovician Period in a local environment dominated by deep seas (British Geological Survey Online).



Photograph 1: View northwest across Field 1.



Photograph 2: View northwest across Field 2.

3. METHODOLOGY

3.1 Data Collection

- 3.1.1 The geophysical survey was conducted by an experienced surveyor using a fluxgate gradiometer with two sensors at 1m spacing and with a DL601 data logger. The gradiometers sensitivity was set to detect a magnetic variation in the order of 0.1 nanoTesla.
- 3.1.2 Data was collected within a controlled grid that the surveyors physically marked out on the ground to within 0.1m+/- accuracy. The survey grid was tied into the local Ordnance Survey (OS) grid using a Trimble R8s integrated GNSS system with a TSC3 controller.

3.2 Ground Coverage

- 3.2.1 Geophysical methods rely on a contrast in the physical properties between the buried archaeological remains and the surrounding soil. Therefore, to best characterise archaeological features, it is often necessary to survey a large enough area that not only captures any possible targets but also incorporates a sufficient area of natural background response. Typically, the size of the survey area is constrained by external influences that can adversely impact the survey data (i.e. chain-linked fences, telegraph poles, modern field boundaries, etc). To minimise the affect these can have up to 5m from field boundaries is maintained, a greater distance may be required for larger modern ferrous objects such as pylons.

3.3 Resolution

- 3.3.1 Data was collected in 30m x 30m grids using the zigzag traverse method with a sample interval (x-axis) of 0.25m (four readings per metre) and a line separation (y-axis) of 1m.

3.4 Data Processing

- 3.4.1 The data was processed using *Terrasurveyor 3.0.36.1* and is presented with a minimum of processing.
- 3.4.2 Typically, the data is “de-striped” to remove any striping effect caused by an imbalance between the two sensors. It is then “clipped” to remove high values caused by ferrous objects, which tend to hide fine details and obscure archaeological features, allowing finer details to show through.
- 3.4.3 Other processing functions may include “de-staggering” the data. This is to correct line displacement errors caused by variations in the traversal rate resulting in the sensors being in the incorrect position when taking a reading. Finally, the data may be “interpolated” followed by a “low pass filter”. The gradiometer collects readings every 0.25m along the transect (x-axis) and 1.0m (or 0.25m in the higher resolution surveys), this results in an imbalanced grid, so by interpolating the data and choosing to match the x and y-axis by an increased factor the grid becomes more balanced. The “low pass filter” is used cautiously to smooth the data without removing any archaeology.

3.5 Data Presentation and Interpretation

- 3.5.1 Data is presented with a minimum of processing as a grey-scale plot overlaid on local topographical features. The main magnetic anomalies have been identified using a combination of the grey-scale plots at different stages of processing and XY traces which aid in interpretation by allowing for visualisation of the magnitude and form of a geophysical anomaly.
- 3.5.2 The results have been compared to available sources (satellite imagery, aerial photographs, historic maps etc.) to increase confidence levels, and an interpretation of the results has been formulated. In some instances, it is possible to provide a very specific interpretation to geophysical anomalies, i.e. where its character or form is well documented, its existence was known about before the survey, or corroborative evidence can be found. In other cases, a broader categorisation of interpretation is required (outlined in Table 2). Often, looking at the results as a whole and the environs within which they sit provides greater context and aids in interpreting individual features.

Table 2: Categories of interpretation for geophysical anomalies.

Archaeological features	
<i>Archaeology</i>	Where the character and form of response are clearly archaeological in origin or corroborative evidence exists (i.e. historical sources, excavation, etc.). These are typically made up of linear/curvilinear/rectilinear anomalies. This category also includes pits with a discernible arrangement, grouping or association with an archaeological feature to suggest an archaeological origin.
<i>Industrial/area of burning</i>	Where an anomaly has a strong magnetic response that could be evidence of kilns, heaths etc, their shape, form and context may aid interpretation. Caution should be observed as

	often a similar response can be produced from modern ferrous material.
Possible archaeological feature	
<i>Possible archaeology</i>	Where an archaeological response is favoured, but the response is weak or incomplete and lacks any distinguishing characteristics akin to an archaeological feature. This category also includes possible pits with no discernible pattern, grouping or association with an archaeological feature. They may be of archaeological origin, but they are also likely to represent natural features such as a tree throws (former root bole of a tree shrub).
<i>Area of enhanced magnetic activity</i>	An area that exhibits increased magnetic variations with no discernible pattern or cause. This may have an archaeological origin or a result of the geological variation.
Agricultural features	
<i>Former field boundary</i>	A linear anomaly often seen as a positive response (bank) flanked either side by a negative (response) ditches. These can usually be attributed to former boundaries depicted on historical maps.
<i>Ridge and furrow</i>	A series of regular linear anomalies with consistent broad spacing. If they run parallel with existing field boundaries this might suggest a recent activity.
<i>Plough lines</i>	A series of regular linear anomalies with consistent narrow spacing. If they run parallel with existing field boundaries this might suggest a recent activity.
<i>Field drains</i>	A series of regularly spaced linear anomalies.
Non-archaeological features	
<i>Magnetic interference</i>	An external source that affects the survey data. Usually occurs along the edges of surveys near fences containing ferrous material or around pylons and from subsurface utilities.
<i>Ferrous</i>	These may be associated with an artefact of archaeological interest but generally unless they form a pattern or a part of a larger feature they are regarded as not significant. They are usually the result of miscellaneous modern ferrous-rich debris, such as brick and tile fragments, and objects such as horseshoes or broken ploughshares, which lie within the topsoil and result in a dipole response.
<i>Natural / Geology</i>	These natural variations can cause significant variations in magnetic readings.

4. RESULTS

- 4.1 The geophysical survey results are presented as a grey-scale plot overlaid on a topographical map in Figure 2. The interpretation of the results is provided in Figure 3. In total, an area of 2.02ha was surveyed.

Archaeological Features

- 4.2 No features of clear archaeological origin were identified during the survey.

Possible Archaeological Features

Possible Archaeological Feature 1

- 4.3 Located to the north of the trackway near the southern boundary of field 2 a possible semi-circular feature with a diameter of approximately 4.8m has been observed. The strong positive response would suggest a possible ditch approximately 1m wide and a northwest facing opening.

Possible Archaeological Feature 2

- 4.4 A second possible sub-circular feature has been recorded in the northwest corner of field 2. This feature has a diameter of approximately 9m with a west facing opening. Contained within the circular feature is a possible central feature.

Possible pits

- 4.5 Throughout the survey area possible pits can be seen, these typically manifest as sub circular features with a positive magnitude. Although they may have an archaeological origin they have not been included in the interpretation as there is no supporting evidence to suggest an archaeological interpretation and they are just as likely to be a natural phenomenon.

Agricultural Feature

- 4.6 Parallel linear striations orientated roughly southwest to northwest are likely to represent plough lines. Such striations are a common feature on agricultural land.

Non-Archaeological features

Magnetic interference

- 4.7 Typically where magnetic interference occurs around the edges of the survey area it is because the survey has encroached near to field boundaries that contain metallic items. The areas of magnetic interference labelled as 3 – 6 correspond to the location of exposed manhole covers. Given the similar responses exhibited by Areas 7 – 10 it is likely these are also associated with buried services with areas 11 – 13 possibly related to cables or pipes. Areas 8, 10, 11 and 12 run along a linear alignment from north to south, that would appear to correspond to a former field boundary depicted on historic mapping and may represent material dumped within an infilled ditch associated with this boundary, or potentially material within the now grubbed out hedgebank.

Ferrous (Point)

- 4.8 Discrete dipole anomalies can be seen throughout the survey area and are likely caused by modern ferrous material located within the topsoil.

Natural / Geology

- 4.9 A curvilinear feature runs east – west across the centre of field 1, represented by a slightly higher magnitude. The sinuous nature of the anomaly would suggest a naturally occurring feature, however it also appears to coincide with the locations of identified manhole covers (Areas 3, 4 and 5), and may therefore be associated with modern ground disturbance associated with these works. To avoid over complicating the illustrated interpretation, this is not illustrated on Figure 3.

5. SUMMARY OF RESULTS

- 5.1 Generally the quality of the survey data is good with no evidence of surveyor error present within the results.
- 5.2 No evidence for a Bronze Age round barrow was recorded in the southwest corner of the survey area, where a potential example of a barrow (PRN 3879) has been recorded in the past. This is not to say that the area is definitely void of archaeology. Geophysics relies on archaeological features to be composed of material that contrasts magnetically with its natural surroundings. In this region some Bronze Age barrows are known to be constructed from stone with no associated ditches or other apparent archaeology within the vicinity, which means they may be beyond the range of a gradiometer survey is able to detect. Such an example has been recorded at Cefn Garn Barrow (Enright 2018) evaluated by DAT in 2018. Excavation revealed a well-constructed stone-built barrow, but this was barely discernible as such in the geophysics because of the lack of associated ditch, although the stonework did appear as a general area of slightly more positive responses and was also visible on the surface as a slight earthwork. Therefore, despite the lack of any positive evidence, the potential for less distinct Bronze Age archaeological remains still exists due to the proximity in the area of another Bronze Age barrow (PRN 3878, CM 322) that is still clearly visible as an earthwork.
- 5.3 Two potential archaeological features were detected in Field 2. The first is a small semi-circular feature located to the north of the trackway and the second, a more circular ditch with a central feature, located in the northeast corner of the field. Given the potential for prehistoric archaeology in this area these features may represent remains of round houses or barrows, but their lack of distinct character makes it difficult to determine through geophysics alone.
- 5.4 In most instances the magnetic interference seen across Field 1 could be attributed to exposed manhole covers, buried services and a former field boundary. From this it is possible to infer that similar responses across the surveyed area are likely also caused by buried manholes and modern activity.

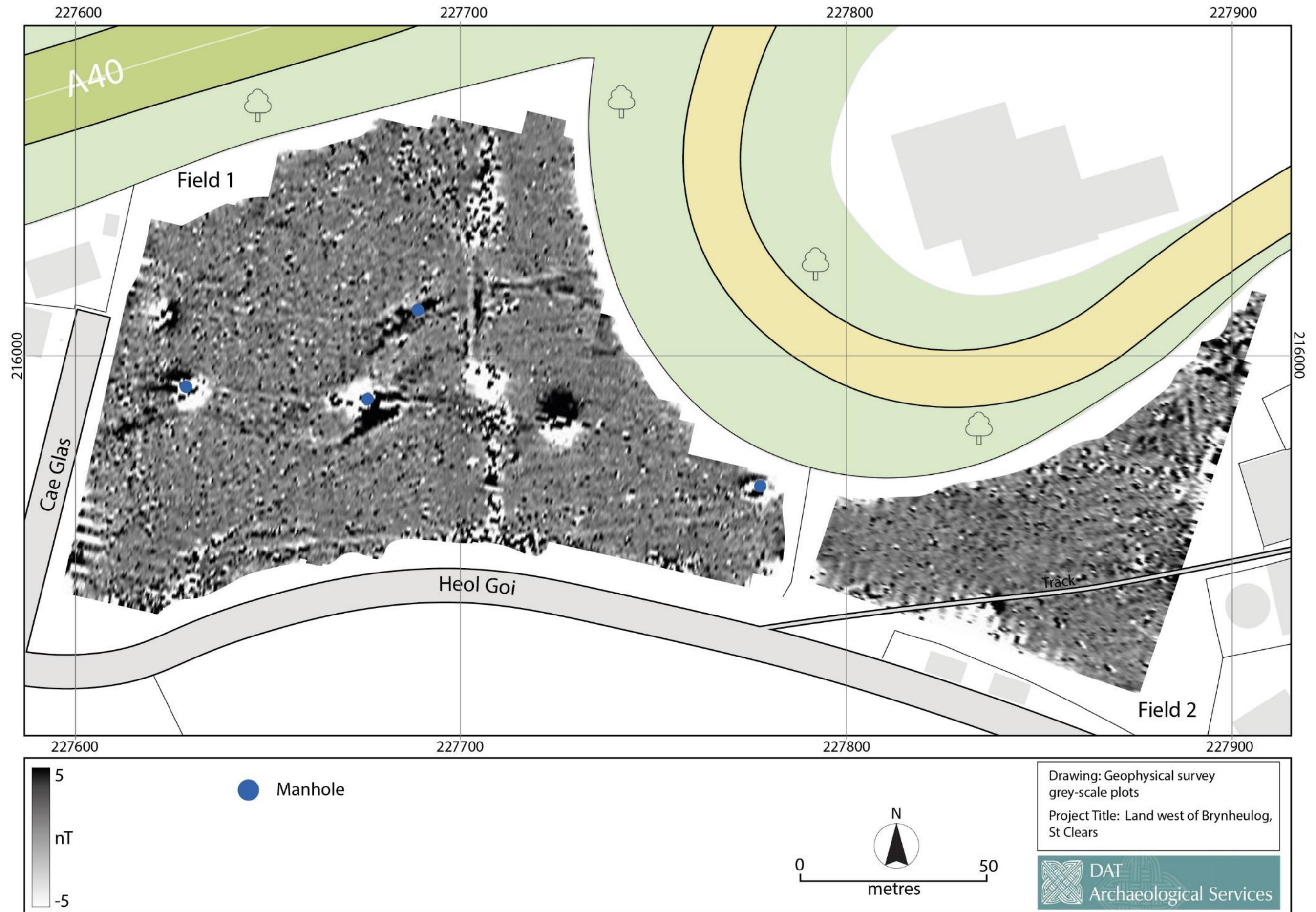


Figure 2: Grey-scale plot of the geophysical survey results.

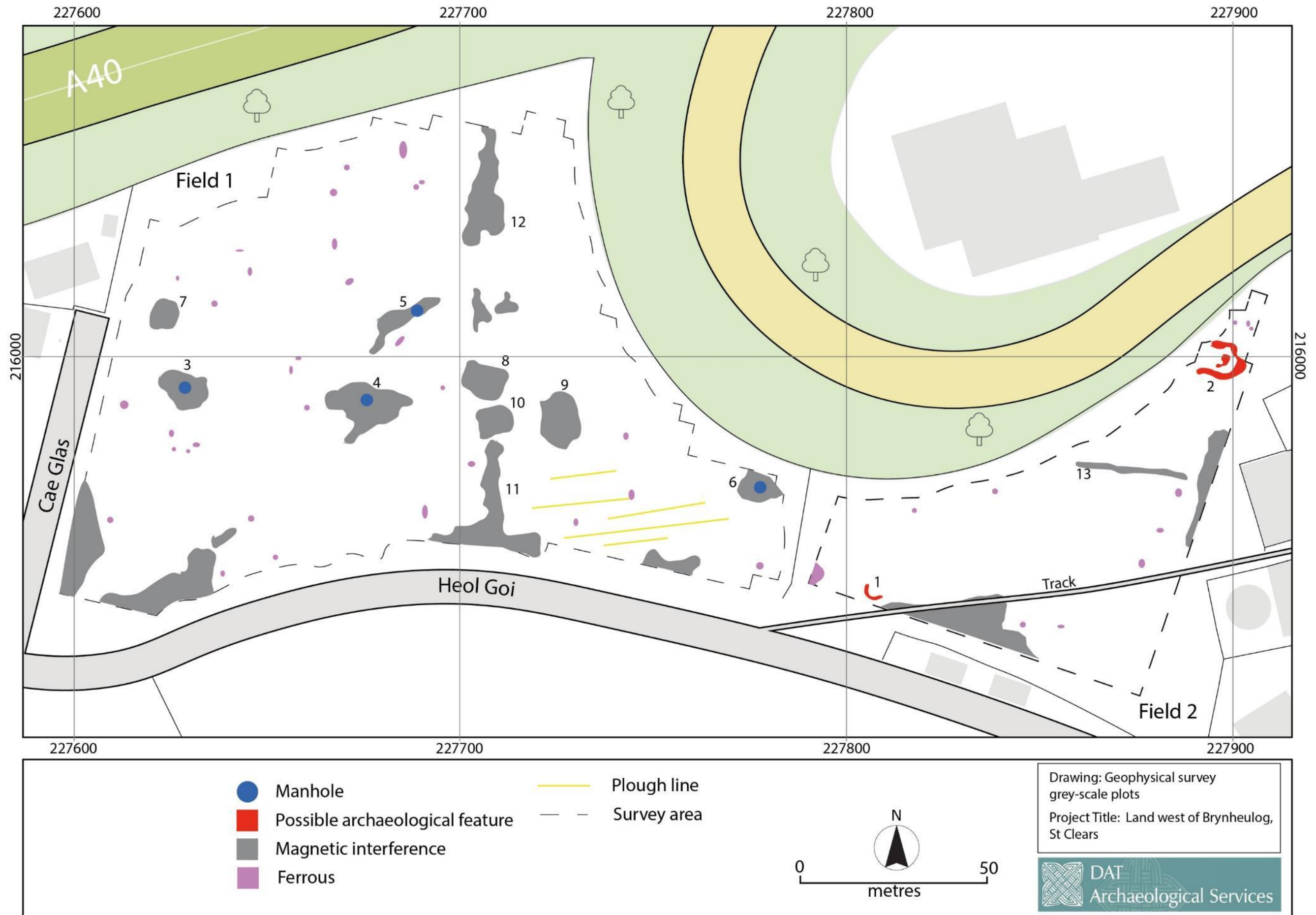


Figure 3: Interpretation plot of geophysical survey results.

6. SOURCES

CIfA, 2014 *Chartered Institute of Field Archaeologists Standards and Guidance for Archaeological Geophysical Survey*

Enright, C., 2018. Cefn Garn Barrow, Ceredigion: Geophysical Survey, Topographical Survey and Archaeological Evaluation 2018. DAT Report No. 2018/03.

National Standard and Guidance for Collecting and Depositing Archaeological Archives in Wales 2017.
<http://www.welshmuseumsfederation.org/en/news-archive/resources-landing/Collections/national-standard-and-guidance-for-collecting-and-depositing-archaeological-archives-in-wales-2017.html>

Online resources

British Geological Survey [online] Date Accessed 14th February, 2020. <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>.

APPENDIX I:

LAND ADJACENT TO BRYNHEULOG, ST CLEARS, CARMARTHENSHIRE: WRITTEN SCHEME OF INVESTIGATION FOR GEOPHYSICAL SURVEY

1 Introduction

- 1.1 This Written Scheme of Investigation (WSI) presents a proposed methodology for a geophysical survey on land adjacent to Brynheulog, St Clears, Carmarthenshire (centred on NGR SN 2775 1602; Figure 1). The proposed development comprises the construction of 62 residential dwellings within an area approximately 2.239ha in size.
- 1.2 During scoping consultation in 2019 The Development Management section of Dyfed Archaeological Trust (DAT-DM), in their capacity as archaeological advisors to the planning authority, reiterated their recommendation that the site should be archaeologically evaluated prior to determination through a phased scheme of investigation commencing with a geophysical survey.
- 1.3 The results of the geophysical survey would inform whether targeted trial trench evaluation of the area was necessary. DAT-DM considered that features/deposits of prehistoric date could potentially extend into the development area, as there are two Bronze Age round barrows (PRNs 3878 and 3879; Figure 1 and Table 1) recorded in close proximity to the southwest boundary; one being Scheduled Monument CM322.
- 1.4 The results of the geophysical survey should provide further information of the archaeological potential of the site through the identification of subsurface features which could be indicative of archaeology. Using a gradiometer, a rapid scan of the site area will be undertaken, which through the measurement of tiny variations in the earth's magnetic field, can indicate the presence of buried features such as ditches, pits, walls or postholes, which are not visible on the ground surface.
- 1.5 The survey will be carried out using a fluxgate gradiometer, which detects variations in the earth's magnetic field. Readings will be taken at a medium resolution on traverses 1.0m wide and every 0.25m within a 20m x 20m grid across the field. A Trimble TST will be used to tie the survey grid into the local Ordnance Survey grid. This resolution enables a relatively speedy survey to be carried out (using a single gradiometer and team of two) and provides good results, assuming that the geology of the area will be conducive to gradiometer survey and that the site does not contain obstructions that would make an even walking pace impossible.
- 1.6 This Written Scheme of Investigation is in accordance with the relevant Institute for Archaeologists Standard and Guidance for archaeological geophysical survey (Chartered Institute for Archaeologists (CIfA 2014).
- 1.7 The Trust always operates to best professional practice. DAT Archaeological Services has its own Health and Safety Policy, and all works are covered by appropriate Employer's Liability and Public Liability Insurances. Copies of all are available on request.
- 1.8 ***Dyfed Archaeological Trust is a CIfA Registered Organisation.***

- 1.9 ***All permanent staff members of DAT Archaeological Services are CSCS² registered.***

2 AIM AND OBJECTIVES OF THE PROJECT

- 2.1 This document provides a scheme of works for:

The implementation of a geophysical survey on land proposed for new residential dwellings at Brynheulog, St Clears, Carmarthenshire. A report and archive of the results will be prepared.

- 2.2 The specific aims of the investigation are:

- To undertake a geophysical survey using gradiometer of the entire development area,
- To determine the likely presence or absence of any archaeological remains within the proposed development area,
- To inform the need (or otherwise) for any future archaeological works on the site by means of an illustrated report on the geophysical survey.

- 2.3 The objectives of the project are:

- to undertake work in accordance with national best practice and guidelines,
- to archaeologically record through geophysical survey, any deposits, features or structures of significance,
- to analyse any remains with reference to the existing documentary evidence for historical development and land use,
- to produce a written account to include: summary; site description; anomaly descriptions, possible interpretation and conclusions,
- Provide an ordered archive.

- 2.4 The following tasks will be completed:

- Provision of a Written Scheme of Investigation to outline the methodology for the geophysical survey which DAT Archaeological Services will undertake (this document);
- To identify the presence/absence of any potential archaeological deposits through gradiometer survey;
- To use the information obtained to design a specification for future mitigation at the site, which will enable any identified remains to be appropriately investigated and recorded where they will be affected by the proposed development.

² Construction Skills Certification Scheme (Health and Safety Tested)

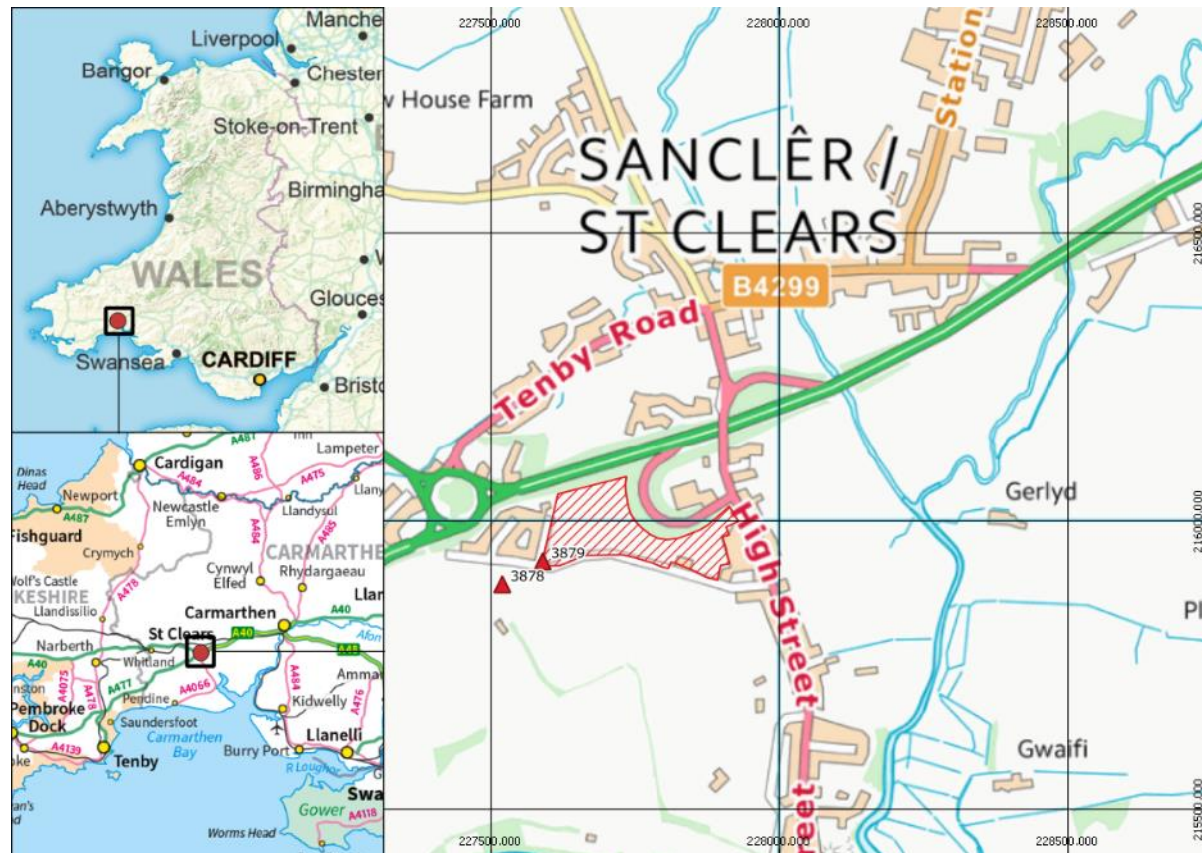


Figure 1: Location map of development area (outlined in red). Source: data hub. Miniscale: A simple overview map of Great Britain. Credit OS, ONS. Location of Bronze Age round barrows shown by red triangles (Descriptions in Table 1).



Figure 2: Site location plan provided by client.

PRN	Description
3878	A SUBSTANTIAL ROUND BARROW TRUNCATED ON ITS NW EDGE BY A HEDGE LINE AND TRACK LEADING DOWN TO MAES Y COED FARM. THE MOUND STANDS TO A GOOD HEIGHT, C1.2M, AND HAS A CLEARLY DEFINED CIRCULAR EDGE AND ROUNDED PROFILE. THE MOUND APPEARS TO HAVE BEEN DUG INTO ON ITS SOUTHERN SIDE AT SOME POINT, BUT OTHERWISE THE BARROW IS IN A VERY GOOD CONDITION. CROPMARK BARROW (PRN 3879), C. 80M TO THE NE, IS ON SLIGHTLY LOWER GROUND AND COULD MEAN THAT ORIGINALLY THIS WAS ONE OF A BARROW PAIR INTERVISIBLE WITH EACH OTHER. N BESTLEY PFRS 2001 Scheduled Monument CM322
3879	UNABLE TO SEE ANY VISIBLE TRACE OF THIS CROPMARK ROUND BARROW IN THE FIELD, ALTHOUGH WHEN EXTANT THIS MOUND WOULD HAVE BEEN ONE OF A BARROW PAIR; ITS TWIN (PRN 3878) LOCATED C,80M TO THE SW OF THIS SITE AND INTERVISIBLE WITH IT. BOTH BARROWS ARE NOW SEPARATED BY A SMALL ROAD. N BESTLEY PFRS 2001

TABLE 1: DESCRIPTIONS OF BRONZE AGE ROUND BARROWS (TABLE 1)
EXTRACTED FROM THE HISTORIC ENVIRONMENT RECORD (HER).

3 GEOPHYSICAL SURVEY METHODOLOGY

- 3.1 The results of the geophysical survey should provide further information of the archaeological potential of the site through the identification of subsurface features which could be indicative of archaeology. The aim of the survey is to assess, characterise and locate surviving below ground archaeology.
- 3.2 A localised site grid using 20m x 20m or 30m x 30m grids will be established and marked out physically on the ground to within 0.1m+/- accuracy. The survey grid will be tied into the Ordnance Survey (OS) grid using a Trimble R8s integrated GNSS system with TC£ controller.
- 3.3 A fluxgate gradiometer will be used for the survey, which detects subtle variations in the earth's magnetic field. Technical information is given in Appendix I at the end of this document.
- 3.4 Data is collected using the zigzag traverse method within each grid with a sample interval (x-axis) of 0.25m (four readings per meter) and a line separation (y-axis) of 1.0m. The line separation is reduced to 0.5m traverses if greater resolution is required.
- 3.5 Ground coverage is important to aid with interpretation and as large of a survey area as practicable possible will be surveyed. But efforts will be made to keep a suitable distance from external ferrous sources that could impact adversely upon the results.
- 3.6 The data will be processed using *Terrasurveyor 3.0.36.1* and presented with a minimum of processing as a grey-scale plot. The main magnetic anomalies will be identified and plotted onto the local topographical features.
- 3.7 The survey results and interpretation diagrams should not be seen as a definitive model of what lies beneath the ground surface, not all buried

features will provide a magnetic response that can be identified by the gradiometer. In interpreting those features that are recorded the shape is the principal diagnostic tool, along with comparison with known features from other surveys. The intensity of the magnetic response could provide further information, a strong response for example indicates burning, high ferric content or thermoremnancy in geology. The context may provide further clues but the interpretation of many of these features is still largely subjective.

- 3.8 All measurements given will be approximate as accurate measurements are difficult to determine from fluxgate gradiometer surveys. The width and length of identified features can be affected by its relative depth and magnetic strength.
- 3.9 The interpretation diagrams will be used to identify the presence/absence of any potential archaeological deposits and features and will help decide whether further archaeological investigation is necessary in this area.
- 3.10 The interpretation diagrams will be used to identify the presence/absence of any potential archaeological deposits and features and will help decide whether further archaeological mitigation is necessary in this area, following discussions with the archaeological advisor to the planning authority.

4 POST-FIELDWORK REPORTING AND ARCHIVING

- 4.1 An archive will be prepared if it meets the requirements of the Dyfed Archaeological Trust archive retention policy (2018). If it does, then data recovered during the evaluation will be collated into a site archive structured in accordance with the specifications in Archaeological Archives: a guide to best practice in creation, compilation, transfer and curation (Brown 2011), and the procedures recommended by the National Monuments Record, Aberystwyth. The National Standards for Wales for Collecting and Depositing Archaeological Archives produced by the Federation of Museums and Art Galleries of Wales will also be adhered to. Digital archives will be collated using the Royal Commission on the Ancient and Historical Monuments of Wales systems (2015) and deposited with the RCAHMW. The Guidance for the Submission of Data to the Welsh Historic Environment Records (HERs) shall be followed.
- 4.2 The results of the fieldwork will be assessed in local, regional and wider contexts.
- 4.3 The results will be used to inform subsequent design considerations of the proposed development so that they can aim to avoid impacts upon any archaeological remains or that further archaeological mitigation can be implemented before such remains are disturbed.
- 4.4 A summary of the project results, excluding any confidential information, may be prepared for wider dissemination (e.g. Archaeology in Wales and special interest and period-specific journals).
- 4.5 The report will be prepared to follow the Standard and Guidance for Archaeological Geophysical Survey (CIfA S&G: AWB 2014).

- 4.6 Digital copies of the report will be provided to the client, as well as the Heritage Officer (Archaeology) Brecon Beacons National Park, and the Regional Historic Environment Record.

5 STAFF

- 5.1 The project will be managed by Fran Murphy MCIfA.
- 5.2 The on-site works will be undertaken by experienced archaeologists, from DAT Archaeological Services.

6 QUALITY ASSURANCE

- 6.1 DAT Archaeological Services has considerable experience of undertaking all categories of archaeological fieldwork and always operates to best professional practice; adhering to CIfA guidelines where appropriate. The Trust is a Registered Organisation with CIfA and all staff abide by their code of conduct and adhere to their relevant standards and guidance.
- 6.2 DAT Archaeological Services operate robust internal monitoring procedures that ensure that the standard of each project is maintained from commencement to completion.

7 MONITORING

- 7.1 The fieldwork may require monitoring by the archaeological advisor to the planning authority, DAT-DM who should be told of the commencement of the works. The fieldwork may also need to be monitored by the Head of DAT Archaeological Services.
- 7.2 All parties should be provided with free access to the site at any time during the geophysical survey.

8 HEALTH AND SAFETY

- 8.1 All permanent members of staff should be CSCS registered.
- 8.2 Service information should be obtained prior to the start of the works.
- 8.3 A health and safety risk assessment must be prepared prior to the works commencing to ensure that all potential risks are minimised.
- 8.4 The site staff will go through the health and safety risk assessment prior to works commencing and all site staff must sign the document to confirm that they have read, understood and will comply with the document.
- 8.5 All site inductions, H&S procedures, H&S constraints and site rules of the client or any on-site contractor should be made known to the archaeological staff at the start of the works.
- 8.6 All relevant health and safety regulations must be followed, including compliance with Welsh Government guidelines on working practices during the current Covid-19 Pandemic, and guidance issued by CIfA.
- 8.7 CIfA recommends that ROs should ensure that their own risk assessments and local site operating procedures take account of [Prospect's COVID-19 site working advice](#) (updated 4 May 2020).. If the site cannot operate in line with this guidance it must not open or continue to stay open.
- 8.8 The project risk assessment should detail the precautions put in place to reduce the spread of Covid-19 coronavirus during fieldwork.

- 8.9 Safety helmets, high visibility vests and boots are to be used by all site personnel as necessary. The developer will make all site staff aware of any other PPE that may be required.
- 8.10 Working with machinery: all staff must ensure that their presence on site is communicated to all relevant site contractor staff, especially the machine operator. The archaeologist observing the topsoil stripping by machine will establish a safe working procedure with the machine operator at the start of work. This will include explaining the purpose of the works itself and the method by which the trenches shall be machined. This will include ensuring that the machine driver is aware that topsoil is stripped carefully to avoid disturbing archaeology. This will also include discussing the methodology for safe working, ensuring that no machining is done without an archaeologist being present.

9 ARBITRATION

- 9.1 Any dispute or disagreement arising out of a contract in relation to this work shall be referred for a decision to the Chartered Institute of Archaeologist's arbitration scheme.

APPENDIX I – TECHNICAL INFORMATION

The survey will be carried out using a Bartington Grad601-2 dual Fluxgate Gradiometer, which uses a pair of Grad-01-100 sensors. These are high stability fluxgate gradient sensors with a 1.0m separation between the sensing elements, giving a strong response to deeper anomalies.

The instrument detects variations in the earth's magnetic field caused by the presence of iron in the sub-surface material. This is usually in the form of weakly magnetised iron oxides, which tend to be concentrated in the topsoil. Features cut into the subsoil and backfilled or silted with topsoil therefore contain greater amounts of iron and can therefore be detected with the gradiometer. There are also other processes and materials that can produce detectable anomalies. The most obvious is the presence of pieces of iron in the soil or immediate environs, which usually produce very high readings. Features such as hearths or kilns also produce strong readings because fired clay acquires a permanent thermo-remnant magnetic field upon cooling.

The Bartington Grad601 is a hand-held instrument and readings are taken automatically as the operator walks at a constant speed along a series of fixed length traverses. The sensor consists of two vertically aligned fluxgates set 1.0m apart. Their Mumetal cores are driven in and out of magnetic saturation by an alternating current passing through two opposing driver coils. As the cores come out of saturation, the external magnetic field can enter them producing an electrical pulse proportional to the field strength in a sensor coil. The high frequency of the detection cycle produces what is in effect a continuous output (Clark 1996).

The gradiometer can detect anomalies down to a depth of approximately one metre. The magnetic variations are measured in nanoTeslas (nT). The earth's magnetic field strength is about 48,000 nT; typical archaeological features produce readings of below 15nT although burnt features and iron

objects can result in changes of several hundred nT. The instrument is capable of detecting changes as low as 0.1nT.

The gradiometer includes an on-board data-logger. Readings in the surveys will be taken along parallel traverses of one axis of a grid made up of 30m x 30m squares. The traverse intervals will be set 0.5m apart. Readings are logged at intervals of 0.25m along each traverse giving 3200 readings per grid square (medium resolution on 0.5m traverses),

A Trimble GPS will be used to set out the survey grid and to tie the survey grid into the local Ordnance Survey grid. The grid will be marked out with the use of temporary bamboo canes and small plastic pegs. All markers will be removed from site once the surveys are complete.

Processing will be performed using *TerraSurveyor 3.0*. The data will be presented with a minimum of processing. The presence of high values caused by ferrous objects, which tend to hide fine details and obscure archaeological features, will be 'clipped' to remove the extreme values allowing the finer details to show through.

The processed data will be presented as grey-scale plots overlaid on local topographical features. Raw data and trace plots (x-y) will also be provided. The main magnetic anomalies will be identified and plotted onto the local topographical features as a level of interpretation.

The resulting survey results and interpretation diagrams should not be seen as a definitive model of what lies beneath the ground surface, not all buried features will provide a magnetic response that can be identified by the gradiometer. In interpreting those features that are recorded the shape is the principal diagnostic tool, along with comparison with known features from other surveys. The intensity of the magnetic response could provide further information, a strong response for example indicates burning, high ferric content or thermoremnancy in geology. The context may provide further clues but the interpretation of many of these features is still largely subjective.

All measurements given will be approximate as accurate measurements are difficult to determine from fluxgate gradiometer surveys. The width and length of identified features can be affected by its relative depth and magnetic strength.

The interpretation diagrams will be used to identify the presence/absence of any potential archaeological deposits and features and will help decide whether further archaeological mitigation is necessary in this area, following discussions with the archaeological advisor to the planning authority.

