1551

TIR ODDI AR FFORDD TY DU / LAND OFF TY DU ROAD, GLAN CONWY

Gwerthusiad Archeolegol (Arolwg Geoffisegol) / Archaeological Evaluation (Geophysical Survey)

Ymddiriedolaeth Archaeolegol Gwynedd
Gwynedd Archaeological Trust

TIR ODDI AR FFORDD TY DU / LAND OFF TY DU ROAD, GLAN CONWY

Gwerthusiad Archeolegol (Arolwg Geoffisegol) / Archaeological Evaluation (Geophysical Survey)

Yr Amgylchedd Hanesyddol yn Cofnodi Prif Gyfeirnod /
Historic Environment Record Event Primary Reference Number 45820

Prosiect Rhif / Project No. G2643

Adroddiad Rhif / Report No. 1551

Wedi'i baratoi ar gyfer / Prepared for:
Brenig Construction

Mehefin 2020 / June 2020

Ysgrifenwyd gan / Written by: Dave Hopewell

Cyhoeddwyd gan Ymddiriedolaeth Achaeolegol Gwynedd
Ymddiriedolaeth Archaeolegol Gwynedd
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CONTENTS

Figures

CRYNODEB ANNHECHNEGOL

Comisiynwyd Ymddiriedolaeth Archaeolegol Gwynedd gan Brenig Construction i gynnal arolwg geoffisegol yn cefnogi cais cynllunio ar gyfer datblygiad preswyl arfaethedig ar dir gerllaw Ffordd Tŷ Du, Glan Conwy. Roedd ardal yr arolwg yn mesur 2.87ha ac fe'i cynhaliwyd ym Mai 2020. Datgelodd yr arolwg nodweddion archaeolegol posib sydd angen ymchwiliad pellach er mwyn penderfynu eu tarddiad. Mae'r dehongliad cyfredol yn awgrymu bod gweithgarwch yn cynnwys ffiniau caeau a thracffyrdd blaenorol. Byddai ymchwiliad yn gallu cynnwys agor ffosydd prawf neu gloddfa darged, a dylid eu cynnal cyn cychwyn gosod unrhyw sylfaenwaith yn ymwneud â'r adeiladu arfaethedig.

NON-TECHNICAL SUMMARY

Gwynedd Archaeological Trust was commissioned by Brenig Construction to undertake a geophysical survey in support of a planning application for a proposed residential development on Land off Ty Du Road, Glan Conwy. The survey area measured 2.87ha and was undertaken in May 2020. The survey detected possible archaeological features that require further investigation to determine origin. Current interpretation suggests activity could include former field boundaries and trackways. Investigation could include trial trenching or targeted excavation, which should be undertaken prior to the commencement of any proposed construction related groundwork.

1 INTRODUCTION

Gwynedd Archaeological Trust (GAT) was commissioned by Brenig Construction to undertake a geophysical survey in support of a planning application for a proposed residential development on Land off Ty Du Road, Glan Conwy (NGR SH8061075650; postcode: LL28 5NE; Figure 01). The survey area initially measured 6.68ha and included two irregular shaped plots incorporating agricultural land; subsequently, the westernmost plot was excluded from the survey at the request of Brenig Construction, reducing the survey area to 2.87ha. The archaeological mitigation was monitored by the Gwynedd archaeological Planning Service (GAPS) and undertaken in May 2020 in accordance with an approved written scheme of investigation (cf. Appendix I) and the following guidelines:

- *Guidelines for digital archives* (Royal Commission on Ancient and Historic Monuments of Wales, 2015);
- *Management of Archaeological Projects* (English Heritage, 1991);
- *Management of Research Projects in the Historic Environment: The MoRPHE Project Managers' Guide* (Historic England, 2015); and
- *Standard and Guidance for Archaeological Geophysical Survey* (Chartered Institute for Archaeologists, 2014).

In line with the Gwynedd Historic Environment Record (HER) requirements, the HER was contacted at the onset of the project to ensure that any data arising was formatted in a manner suitable for accession to the HER and follows the guidance set out in *Guidance for the Submission of Data to the Welsh Historic Environment Records (HERs)* (The Welsh Archaeological Trusts, 2018). The GAT HER Enquiry Number for this project is GATHER1248 and the Event PRN is 45820.

2 BACKGROUND

GAT completed an archaeological assessment of the proposed development area in 2019 (GAT Report 1493). The regional Historic Environment Record (HER) did not show any known assets within the confines of the assessment plots and the local area was mostly characterised by post-medieval activity. No other archaeological project work was listed within the HER as having been completed within the proposed development area, but GAT completed an assessment along the A470 road to the immediate southwest for the proposed A470 Trunk Road Pentrefelin to Bodnant Improvement Scheme (Evans & Smith, 2008). The report characterised that local area as "representing a farming landscape with a field pattern little changed from the 18th century, but with some fragments of landscape and possible trackways surviving from earlier periods" (ibid, 04).

In total, 29 assets were identified within a 1km radius of the centre point of the proposed development area with 4 assets within very close proximity to the study area. These features were the four Grade II listed buildings: Hafod (PRN 66870), the garage adjacent to Hafod (PRN 66875), the Ty Du farmhouse (PRN 12613) and the agricultural ranges associated with Ty Du (69014). A partial walkover survey was completed of the study area as no fields were fully accessible at the time of completion. This walkover survey did not identify any new archaeological assets but the report concluded that assets may have been obscured by high grass and vegetation.

A copy of the assessment report was consulted as part of the survey to assist with interpretation of the results.

3 METHODOLOGY

3.1 Introduction

The survey area measured 2.87ha and included an irregular shaped plots incorporating agricultural land (NGR SH8061075650; postcode: LL28 5NE; Figure 01). The survey was undertaken in May 2020 and completed by GAT team members.

3.2 Geophysical Survey

3.2.1 Summary

The survey was carried out in a series of 20m grids, which was tied into the Ordnance Survey grid using a Trimble R8 high precision GPS system. The survey was conducted using a Bartington Grad 601-2 dual fluxgate gradiometer with a 1.0m traverse interval and a 0.25m sample interval.

3.2.2 Instrumentation

The Bartington Grad 601-2 dual fluxgate gradiometer 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 soil. This is usually in the form of weakly magnetized 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. This is a simplified description as there are other processes and materials which 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 and can mask the relatively weak readings produced by variations in the soil. Strong readings are also produced by archaeological features such as hearths or kilns as fired clay acquires a permanent thermo-remnant magnetic field upon cooling. This material can also get spread into the soil leading to a more generalized magnetic enhancement around settlement sites. Not all surveys can produce good results as results can be masked by large magnetic variations in the bedrock or soil or high levels of natural background "noise" (interference consisting of random signals produced by material with in the soil). In some cases, there may be little variation between the topsoil and subsoil resulting in undetectable features. The Bartington Grad 601 is a hand

held instrument and readings can be 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 500mm apart. Their cores are driven in and out of magnetic saturation by a 1,000Hz 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. The gradiometer can detect anomalies down to a depth of approximately one meter. 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 machine is capable of detecting changes as low as 0.1nT.

3.2.3 Data Collection

The gradiometer includes an on-board data-logger. Readings are taken along parallel traverses of one axis of a 20m x 20m grid. The traverse interval is 1.0m and readings are logged at intervals of 0.25m along each traverse. Marked guide ropes are used to ensure high positional accuracy during the high resolution survey. The data is transferred from the data-logger to a computer where it is compiled and processed using ArchaeoSurveyor2 software. The data is presented as a grey scale plot where data values are represented by modulation of the intensity of a grey scale within a rectangular area corresponding to the data collection point within the grid. This produces a plan view of the survey and allows subtle changes in the data to be displayed. This is supplemented by an interpretation diagram showing the main feature of the survey with reference numbers linking the anomalies to descriptions in the written report. It should be noted that the interpretation is based on the examination of the shape, scale and intensity of the anomaly and comparison to features found in previous surveys and excavations etc. In some cases the shape of an anomaly is sufficient to allow a definite interpretation e.g. a Roman fort. In other cases all that can be provided is the most likely interpretation. The survey will often detect several overlying phases of archaeological remains and it is not usually possible to distinguish between them. Weak and poorly defined anomalies are most 4 susceptible to misinterpretation due to the propensity of the human brain to define shapes and patterns in random background "noise". An assessment of the confidence of the interpretation is given in the text.

3.2.4 Data Processing

The data is presented with a minimum of processing although corrections are made to compensate for instrument drift and other data collection inconsistencies. High readings caused by stray pieces of iron, fences, etc. are usually modified on the grey scale plot as they have a tendency to compress the rest of the data. The data is however carefully examined before this procedure is carried out as kilns and other burnt features can produce similar readings. The data on some 'noisy' or very complex sites can benefit from 'smoothing'. Grey-scale plots are always somewhat pixellated due to the resolution of the survey. This at times makes it difficult to see less obvious anomalies. The readings in the plots can therefore be interpolated thus producing more but smaller pixels and a small amount of smoothing based on a low pass filter can be applied. This reduces the perceived effects of background noise thus making anomalies easier to see. Any further processing is noted in relation to the individual plot.

3.2.5 Aims

The report includes a discussion of the grey scale plot and an interpretation of the any anomalies identified; these anomalies are presented as either positive or negative, suggesting whether they could be cut features (ditches, pits etc.), or built sub-surface features (e.g., banks). Figures are included for the grey scale plot and for the anomaly interpretation. The results of the geophysical survey have been used to inform further recommendations for archaeological investigation.

3.2.6 Presentation of results and interpretation

The results of the survey are presented as a minimally processed greyscale plot (raw data clipped to +/- 15nT) and a processed greyscale plot if further processing or enhancement has been performed. X-Y trace plots of the collected data may also be included if they are necessary to support the interpretation of specific anomalies visible on the greyscale plots. It is usually sufficient to record the magnitude of the anomalies in the text.

Magnetic anomalies are identified, interpreted and plotted onto an interpretative plot with reference numbers linking the anomalies to descriptions in the written report. When interpreting the results, several factors are taken into consideration, including the shape, scale and intensity of the anomaly and the local conditions at the site (geology, pedology, topography, etc.). Anomalies are categorised by their potential origin. Where responses can be related to other existing evidence, the anomalies will be given specific categories, such as Abbey Wall or Roman Road. Where the interpretation is based largely on the geophysical

data, levels of confidence are implied, for example: *Probable*, or *Possible* Archaeology. The former is used for a confident interpretation, based on anomaly definition and/or other corroborative data such as cropmarks. Poor anomaly definition, a lack of clear patterns to the responses and an absence of other supporting data reduces confidence, hence the classification *Possible*.

3.2.7 Interpretation categories

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

Table 1: Geophysical survey anomalies identified

Interpretation Category	**Description**
Archaeology / Probable Archaeology	This term is used when the form, nature and pattern of the responses are clearly or very probably archaeological and/or if corroborative evidence is available. These anomalies, whilst considered anthropogenic, could be of any age.
Possible Archaeology	These anomalies exhibit either weak signal strength and/or poor definition, or form incomplete archaeological patterns, thereby reducing the level of confidence in the interpretation. Although the archaeological interpretation is favoured, they may be the result of variable soil depth, plough damage or even aliasing as a result of data collection orientation.
Industrial / Burnt-Fired	Strong magnetic anomalies that, due to their shape and form or the context in which they are found, suggest the presence of kilns, ovens, corn dryers, metalworking areas or hearths. It should be noted that in many instances modern ferrous material can produce similar magnetic anomalies.
Former Field Boundary (probable and possible)	Anomalies that correspond to former boundaries indicated on historic mapping, or which are clearly a continuation of existing land divisions. *Possible* denotes less confidence where the anomaly may not be shown on historic mapping but nevertheless the anomaly displays all the characteristics of a field boundary.
Ridge and Furrow	Parallel linear anomalies whose broad spacing suggests ridge and furrow cultivation. In some cases, the response may be the result of more recent agricultural activity
Agriculture (ploughing)	Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes.

Interpretation Category	Description
Land Drain	Weakly magnetic linear anomalies, quite often appearing in series forming parallel and herringbone patterns. Smaller drains may lead and empty into larger diameter pipes, which in turn usually lead to local streams and ponds. These are indicative of clay fired land drains.
Natural	These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions.
Magnetic Contamination	Broad zones of strong dipolar anomalies, commonly found in places where modern ferrous or fired materials (e.g. brick rubble) are present.
Service	Magnetically strong anomalies, usually forming linear features are indicative of ferrous pipes/cables. Sometimes other materials (e.g. PVC) or the fill of the trench can cause weaker magnetic responses which can be identified from their uniform linearity.
Ferrous	This type of response is associated with ferrous material and may result from small items in the topsoil, larger buried objects such as pipes, or above-ground features such as fence lines or pylons. Ferrous responses are usually regarded as modern. Individual burnt stones, fired bricks or igneous rocks can produce responses similar to ferrous material.
Uncertain Origin	Anomalies which stand out from the background magnetic variation, yet whose form and lack of patterning give little clue as to their origin. Often the characteristics and distribution of the responses straddle the categories of *Possible Archaeology / Natural* or (in the case of linear responses) *Possible Archaeology / Agriculture*; occasionally they are simply of an unusual form.

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

3.2.8 Archive

A full archive including survey data and any other material resulting from the project has been prepared and the following dissemination applied:

- A digital report(s) has been provided to the client/consultant and GAPS (draft report then final report);
- A paper report, digital report and event summary have been prepared for the regional Historic Environment Record, Gwynedd Archaeological Trust. All digital datasets conform to the required standards set out in *Guidance for the Submission of Data to the Welsh Historic Environment Records (HERs)* (Version 1.1); and
- A digital report and archive (including photographic and drawn) data has been prepared for the Royal Commission on Ancient and Historic Monuments, Wales, in accordance with the *RCAHMW Guidelines for Digital Archives Version 1*.

4 RESULTS

The geophysical survey results are presented as a grey-scale plot of the raw data clipped to +-15nT (Figure 05). Trace plots were not informative beyond demonstrating the magnitude of the anomalies. This is recorded in the text in cases where it is important to differentiate between low magnitude archaeological anomalies with a range of +- 15nT, thermoremnant anomalies with a range of +-50nT and ferrous anomalies with a range of at least +-3000 nT. The survey was completed in drought conditions and comprised five mostly level fields with few obstructions to survey. Buildings and fences produced strong ferrous magnetic anomalies around the edges of the fields. Bedrock was visible and was not strongly magnetic; the natural levels of magnetic noise were low. Anomalies were detected and generally produced low intensity responses. There were very large numbers of small magnetic dipoles indicating ferrous rubbish in the topsoil; this is commonly caused by material introduced into the soil from farmyards by manuring.

Specific anomalies were allocated numerical labels. These are shown on the interpretation plots (Figure 06), listed in a table for each area and discussed in the text.

Table 2: Geophysical survey anomalies identified

Anomaly Number	**Description**	***Category***
1	Probable former stream bed	*Natural*
2	Dumped building rubble or ruined building	*Magnetic Contamination*
3	Dumped rubble or burnt mound	*Magnetic Contamination or Possible Archaeology*
4	Slight remains of field boundary	*Former Field Boundary*
5	Ferrous anomaly from nearby building	*Ferrous*
6	Collection of strong anomalies probably partly ferrous. Probably modern or industrial	*Ferrous*
7	Linear negative anomaly. Possibly a pipe or drain associated with 6	*Uncertain Origin*
8	Meandering linear anomaly possibly water course or drain	*Uncertain Origin*

Anomaly Number	**Description**	***Category***
9	Curvilinear negative anomaly possibly archaeological	*Possible archaeology*
10	Material dumped by hedgerow	*Magnetic Contamination*
11	Rubbish alongside hedgerow	*Magnetic Contamination*
12	Linear anomaly, possibly a drain	*Land Drain*
13	Ferrous pipeline	*Service*
14	Ferrous anomaly possibly associated with 13	*Ferrous*
15	Ferrous anomaly possibly associated with 13	*Ferrous*
16	Former field boundary. Fence on Google Earth aerial photos up to 2009	*Former Field Boundary*
17	A diffuse linear anomaly, possibly indicating a ploughed our former boundary predating the 1842 tithe map (Figure 02)	*Possible Former Field Boundary*
18	A diffuse positive anomaly running alongside the field boundary. Possibly a trackway but could be a natural variation in the soil	*Possible Archaeology*
19	Ferrous anomaly associated with shed in corner of the field	*Ferrous*
20	The south western tip of the field is more magnetically noisy, possibly due to a subdivision shown on the 1840 tithe map	*Agriculture*
21	A cluster of strong responses possibly dumped material	*Magnetic Contamination*

No anomalies were positively identified as significant archaeology. The cluster of features represented by anomalies 6 to 8 are not depicted on historic mapping (Figure 02 to 04) and cannot be readily allocated to any interpretation category; they require further archaeological investigation to confirm origin. The central area represented by anomaly 6 produced readings of up +-3000nT probably indicating a significant ferrous component. Anomalies 7 and 8

appear to lead into anomaly 6 and may be associated with it. It is possible that it is a soakaway or abandoned septic tank associated with the buildings to the south-east. An alternative interpretation could be a light industrial feature of almost any date. The presence of a well-defined curvilinear feature (anomaly 9) to the west could indicate prehistoric activity.

Field boundaries were detected: anomalies 4 and 20 can be seen on the 1842 tithe map (Figure 02), whilst anomaly 16 appears to be a recent boundary. Two diffuse anomalies (17 and 18) appear to define landscape features and could be the ploughed out remnants of a field boundary and trackway/hollow-way that predate the map evidence of 1842.

The field contains several patches of magnetic noise much which is obviously ferrous that are best interpreted as modern contamination. Anomaly 2 seems to contain modern rubble that is visible on the ground surface. The lack of any structure on the map regression suggests that it is more likely be dumped material as opposed to being the remains of a building.

5 DATA APPRAISAL AND CONFIDENCE ASSESSMENT

Background levels of noise were generally low from both the geology and the glacial till. Archaeological features produced weak but clearly-defined anomalies and thermoremnant anomalies were very clearly-defined. The survey was therefore effective and would be expected to have identified most detectable archaeological anomalies. As in all geophysical surveys this cannot be a taken to mean that all archaeology has been identified as some features produce no anomalies or are too small to be detected.

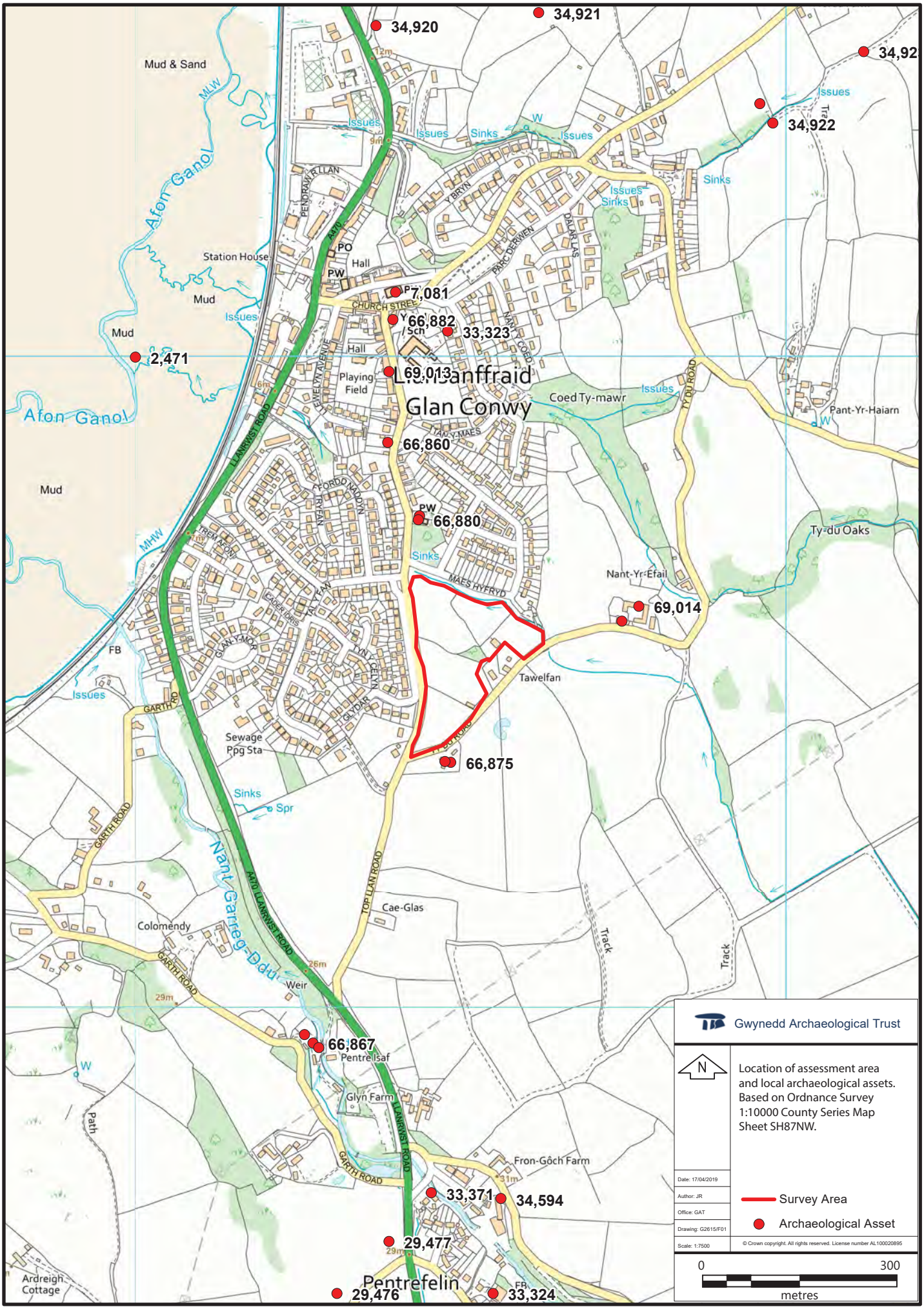
6 CONCLUSIONS

The survey detected a range of possible archaeological features all of which would require further characterisation or verification by a further programme of archaeological evaluation (trial trenching or targeted excavation). The character of anomalies 6 to 9 is not clear and requires further evaluation. Further investigation of the nature and level of survival of field boundaries 4, 17 and possible trackway 18 would also be recommended.

Any further archaeological evaluation should take place prior to the commencement of any proposed construction related groundwork.

7 SOURCES CONSULTED

1. English Heritage, 1991, Management of Archaeological Projects
2. English Heritage, 2015, Management of Research Projects in the Historic Environment (MoRPHE).
3. Evans, R. & Smith, G., 2008, *A470 Cardiff to Glan Conwy Trunk Road: Pentrefelin to Bodnant, Conwy.* GAT Report 675.
4. *Guidance for the Submission of Data to the Welsh Historic Environment Records (HERs)* (Version 1.1)
5. Royal Commission on Ancient and Historic Monuments of Wales 2015 *Guidelines for digital archives*
6. Ryan Young, C. 2019. *Land off Ty Du Road, Glan Conwy Archaeological Assessment*. Gwynedd Archaeological Trust Report 1493.
7. Standard and Guidance for Archaeological Geophysical Survey (Chartered Institute for Archaeologists, 2014).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Nant-Yr-Efail
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Fron-Goch Farm
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Location of assessment area and local archaeological assets. Based on Ordnance Survey 1:10000 County Series Map Sheet SH87NW.
Date: 17/04/2019
Author: JR
Office: GAT
Drawing: G2615/F01
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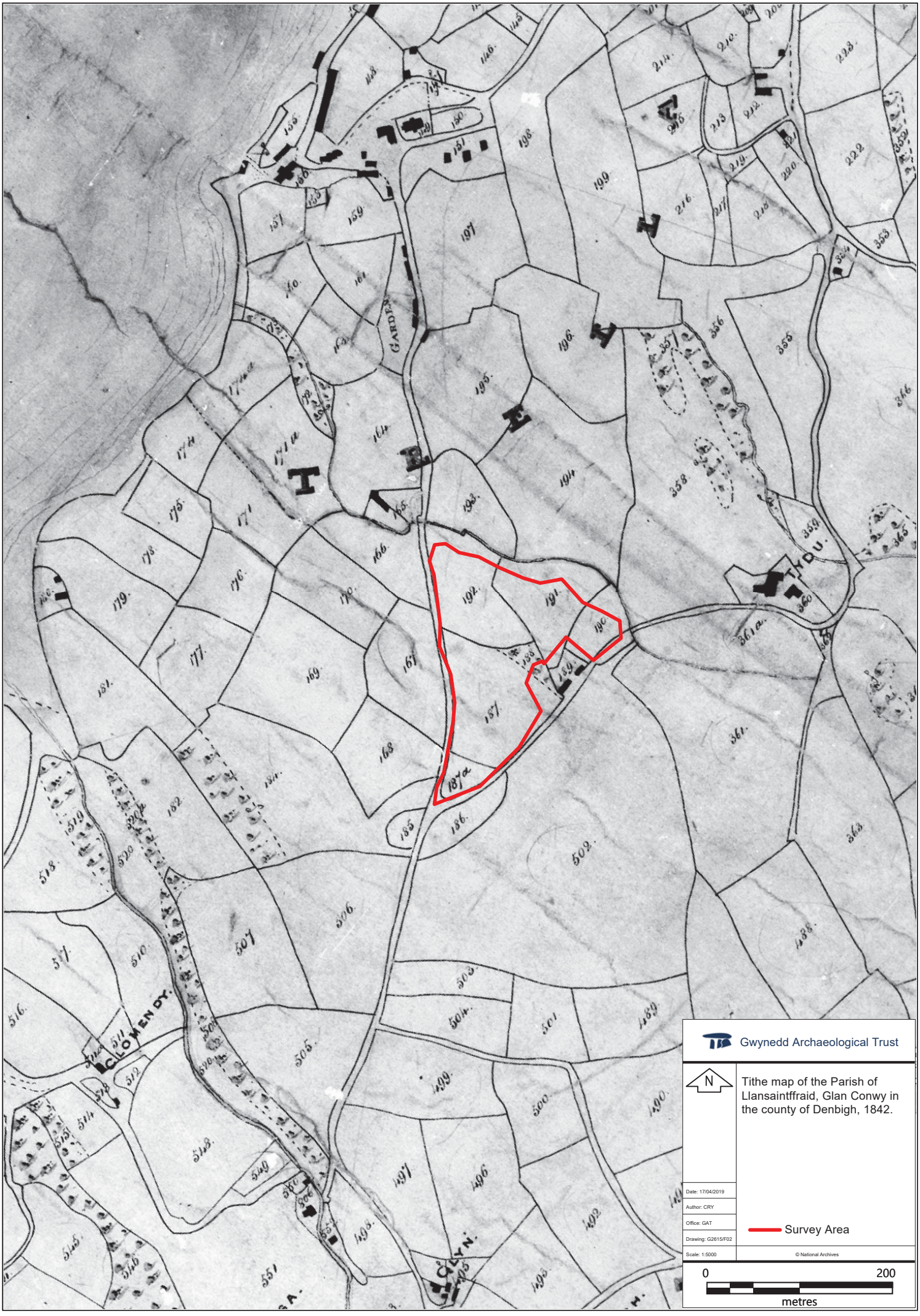
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Tithe map of the Parish of Llansaintffraid, Glan Conwy in the county of Denbigh, 1842.
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Author: CRY
Office: GAT
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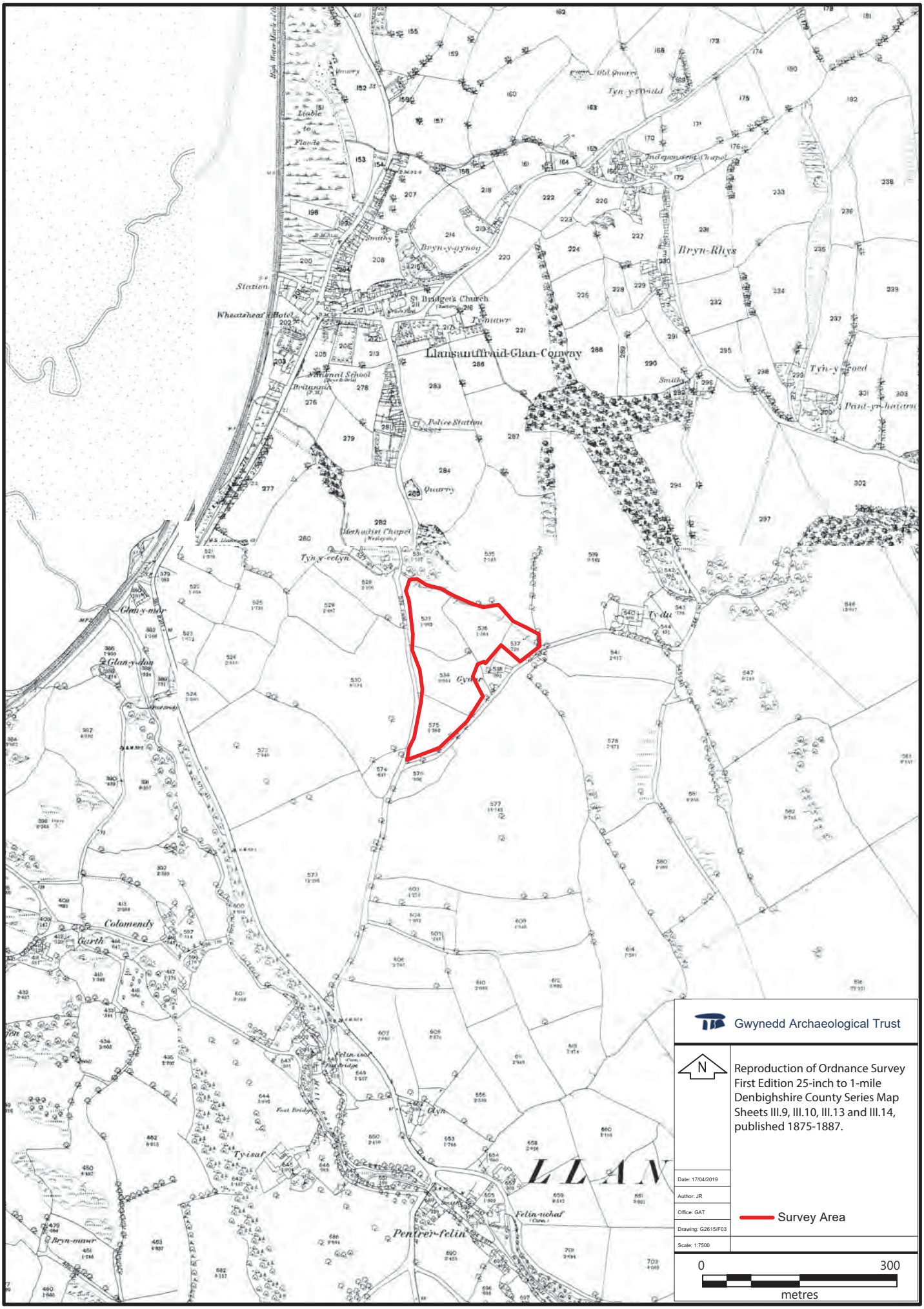

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Reproduction of Ordnance Survey First Edition 25-inch to 1-mile Denbighshire County Series Map Sheets III.9, III.10, III.13 and III.14, published 1875-1887.

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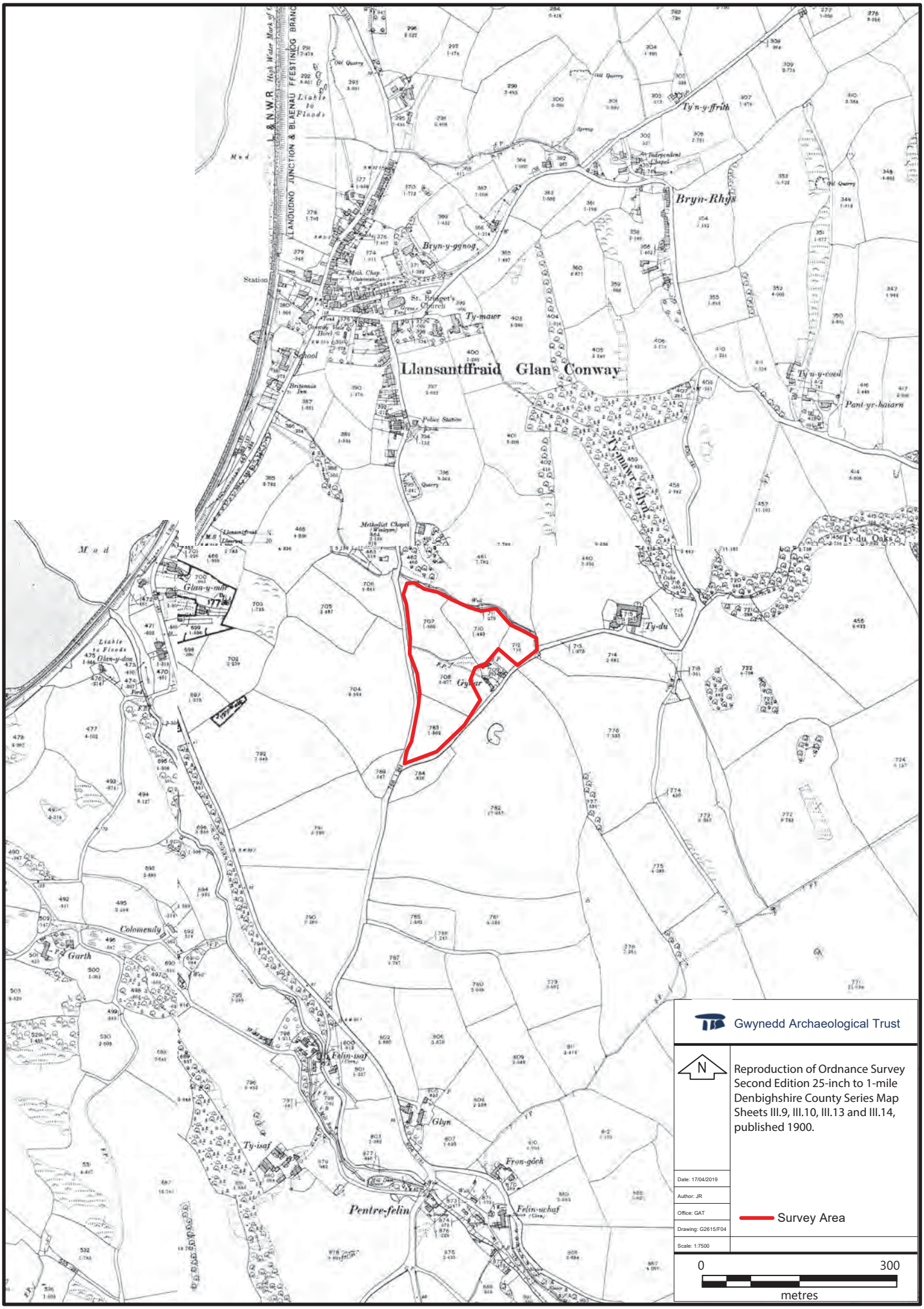
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Glan-y-don
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Glyn
Fron-goch
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Police Station
Methodist Chapel
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Reproduction of Ordnance Survey Second Edition 25-inch to 1-mile Denbighshire County Series Map Sheets III.9, III.10, III.13 and III.14, published 1900.
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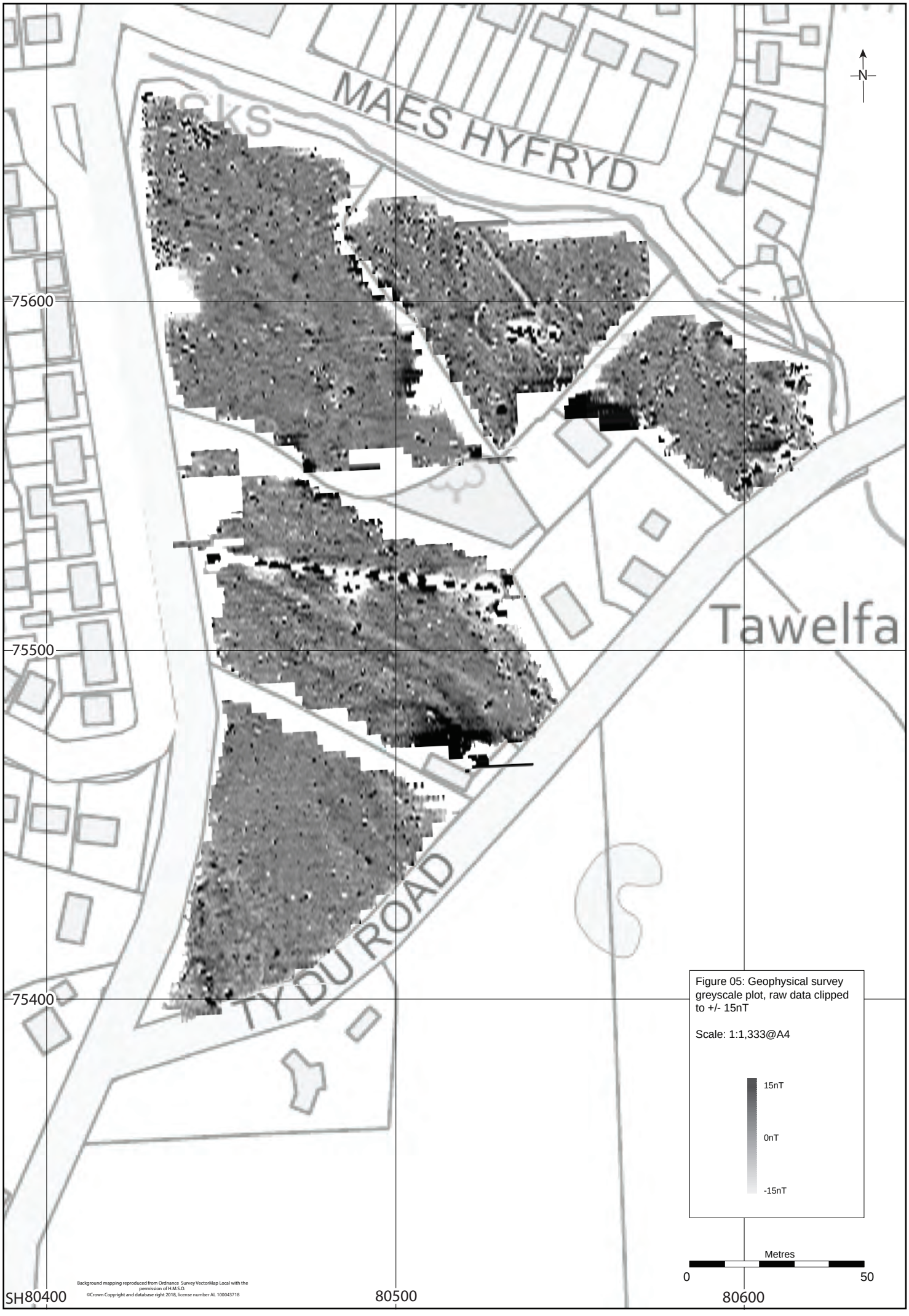

Figure 05: Geophysical survey greyscale plot, raw data clipped to +/- 15nT

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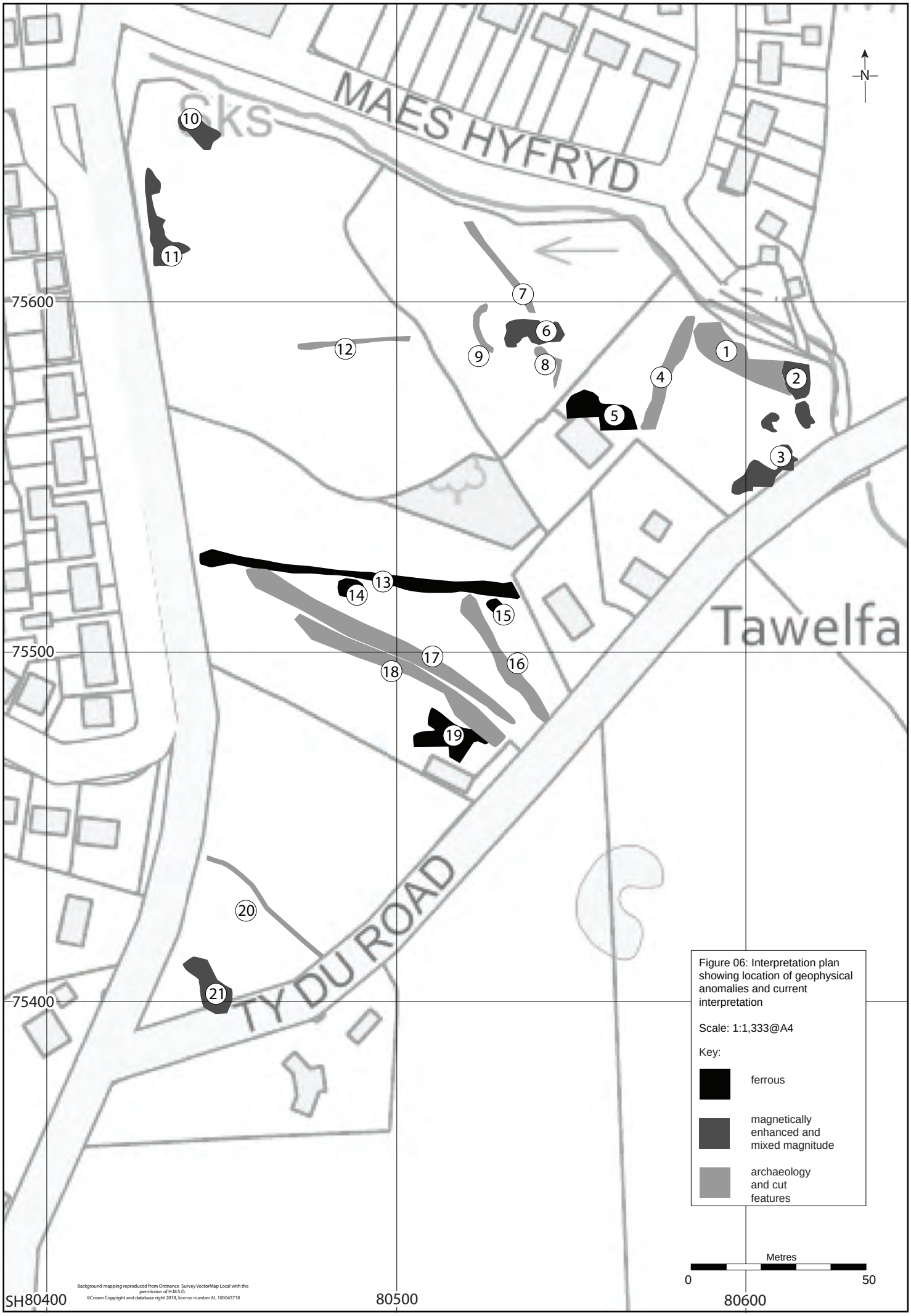
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Figure 06: Interpretation plan showing location of geophysical anomalies and current interpretation
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Background mapping reproduced from Ordnance Survey VectorMap Local with the permission of H.M.S.O.
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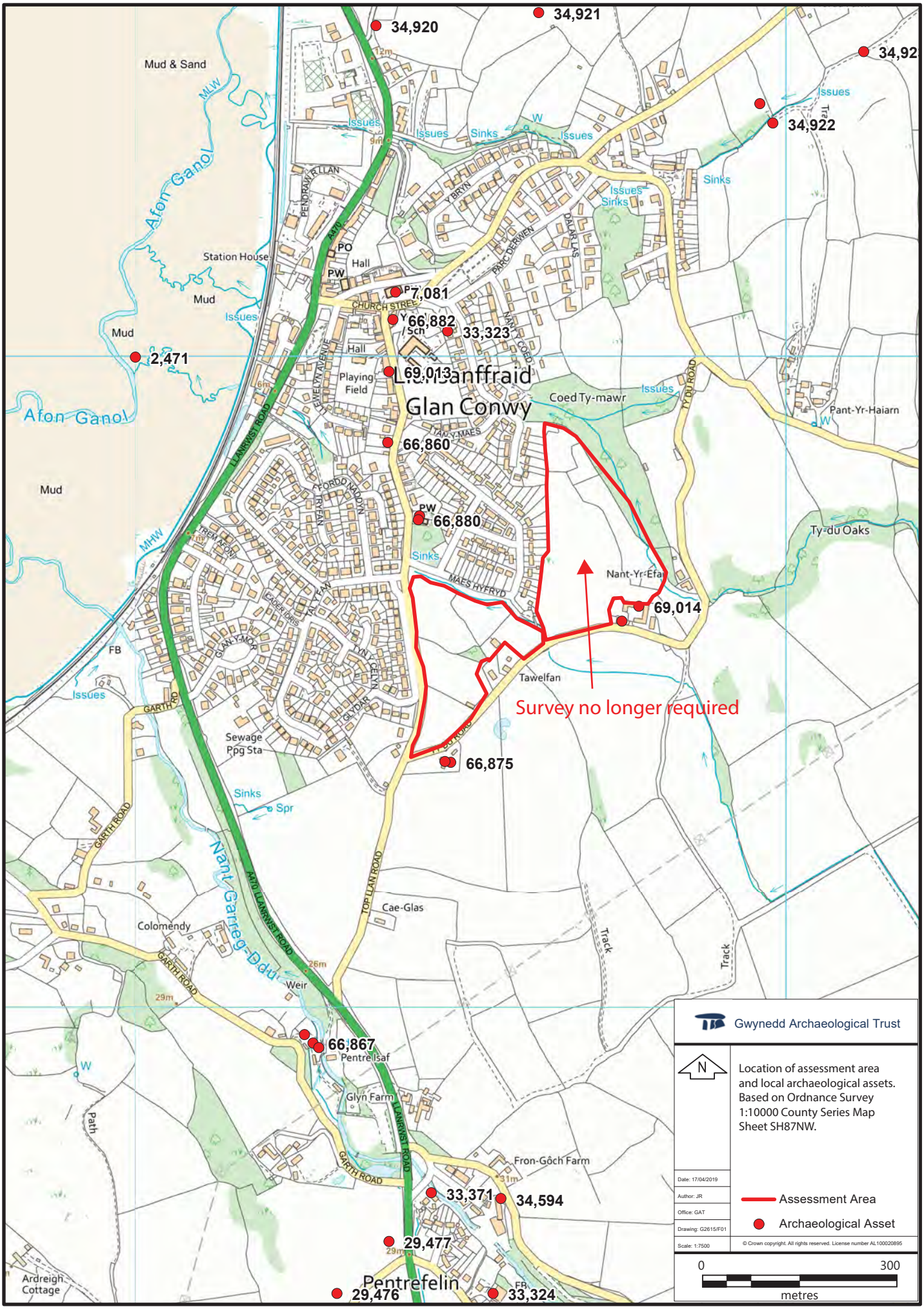
APPENDIX I

Gwynedd Archaeological Trust Written Scheme of Investigation, March 2020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Location of assessment area and local archaeological assets. Based on Ordnance Survey 1:10000 County Series Map Sheet SH87NW.
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Author: JR
Office: GAT
Drawing: G2615/F01
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LAND OFF TY DU ROAD, GLAN CONWY (G2643)

WRITTEN SCHEME OF INVESTIGATION FOR GEOPHYSICAL SURVEY

Prepared for Brenig Construction

March 2020

Ymddiriedolaeth Archaeolegol Gwynedd
Gwynedd Archaeological Trust

Approvals Table				
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Originated by	Document Author	JOHN ROBERTS		13/03/20
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Approved by	Principal Archaeologist	JOHN ROBERTS		13/03/20

Revision History			
Rev No.	Summary of Changes	Ref Section	Purpose of Issue

All GAT staff should sign their copy to confirm the project specification is read and understood and retain a copy of the specification for the duration of their involvement with the project. On completion, the specification should be retained with the project archive:

Name Signature Date

LAND OFF TY DU ROAD, GLAN CONWY (G2643)

WRITTEN SCHEME OF INVESTIGATION FOR GEOPHYSICAL SURVEY

Prepared for *Brenig Construction*, March 2020

CONTENTS

1 INTRODUCTION

Gwynedd Archaeological Trust (GAT) has been asked by Brenig Construction to prepare a written scheme of investigation for a geophysical survey in support of a planning application for a proposed residential development on Land off Ty Du Road, Glan Conwy, Glan Conwy (NGR SH8061075650; postcode: LL28 5NE; Figure 01). The survey area measures 6.68ha and includes two irregular shaped plots incorporating agricultural land. Based on the results of the geophysical survey, further archaeological works may be recommended, which could include targeted trial trenching. Any such works will be defined in future written schemes of investigation further to client and stakeholder agreement.

The geophysical survey will be undertaken from March 2020 and will conform to the following guidelines:

- *Guidance for the Submission of Data to the Welsh Historic Environment Records (HERs)* Version 1.1 (The Welsh Archaeological Trusts, 2018);
- *Guidelines for digital archives* (Royal Commission on Ancient and Historic Monuments of Wales, 2015);
- *Management of Archaeological Projects* (English Heritage, 1991);
- *Management of Research Projects in the Historic Environment: The MoRPHE Project Managers' Guide* (Historic England, 2015); and
- *Standard and Guidance for Archaeological Geophysical Survey* (Chartered Institute for Archaeologists, 2014).

GAT is certified to ISO 9001:2015 and ISO 14001:2015 (Cert. No. 74180/B/0001/UK/En) and is a Registered Organisation with the Chartered Institute for Archaeologists and a member of the Federation of Archaeological Managers and Employers (FAME).

1.1 Monitoring Arrangements

The archaeological mitigation will be monitored by the Gwynedd archaeological Planning Service (GAPS). The content of this WSI and all subsequent reporting by GAT must be approved by GAPS prior to final issue.

1.2 Historic Environment Record

In line with the Gwynedd Historic Environment Record (HER) requirements, the HER will be contacted at the onset of the project to ensure that any data arising is formatted in a manner suitable for accession to the HER and follows the guidance set out in *Guidance for the Submission of Data to the Welsh Historic Environment Records (HERs)* (The Welsh Archaeological Trusts, 2018). The HER will be informed of the project start date, location including grid reference, estimated timescale for the work, and further relevant information associated with the project.

The GAT HER Enquiry Number for this project is GATHER1248 and the Event PRN is 45820. If relevant, the HER will also be responsible for supplying Primary Reference Numbers (PRN) for any new assets identified and recorded.

2 BACKGROUND

GAT completed an archaeological assessment of the proposed development area in 2019 (GAT Report 1493). In total 29 assets were identified within a 1km radius of the centre point of the proposed development area with 4 features in particular being within very close proximity to the study area. These features were the four Grade II listed buildings: Hafod (PRN 66870), the garage adjacent to Hafod (PRN 66875), the Ty Du farmhouse (PRN 12613) and the agricultural ranges associated with Ty Du (69014). A partial walkover survey was completed of the study area as no fields were fully accessible at the time of completion. This walkover survey did not identify any new archaeological assets although they may currently be obscured by high grass and vegetation.

A copy of the assessment report will be consulted as part of the survey to assist with interpretation of the results.

3 METHODOLOGY

3.1 Introduction

The survey area measures 6.68ha and includes two irregular shaped plots incorporating agricultural land (NGR SH8061075650; postcode: LL28 5NE; Figure 01). The survey will be undertaken from March 2020 and will be completed by *Sumo Surveys* on behalf of GAT.

3.2 Geophysical Survey

3.2.1 Summary

The survey will be carried out in a series of 20m grids, which will be tied into the Ordnance Survey grid using a Trimble R8 high precision GPS system. The survey will be conducted using a Bartington Grad 601-2 dual fluxgate gradiometer with a 1.0m traverse interval and a 0.25m sample interval.

3.2.2 Instrumentation

The Bartington Grad 601-2 dual fluxgate gradiometer 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 soil. This is usually in the form of weakly magnetized 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. This is a simplified description as there are other processes and materials which 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 and can mask the relatively weak readings produced by variations in the soil. Strong readings are also produced by archaeological features such as hearths or kilns as fired clay acquires a permanent thermo-remnant magnetic field upon cooling. This material can also get spread into the soil leading to a more generalized magnetic enhancement around settlement sites. Not all surveys can produce good results as results can be masked by large magnetic variations in the bedrock or soil or high levels of natural background "noise" (interference consisting of random signals produced by material with in the soil). In some cases, there may be little variation between the topsoil and subsoil resulting in undetectable features. The Bartington Grad 601 is a hand

held instrument and readings can be 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 500mm apart. Their cores are driven in and out of magnetic saturation by a 1,000Hz 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. The gradiometer can detect anomalies down to a depth of approximately one meter. 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 machine is capable of detecting changes as low as 0.1nT.

3.2.3 Data Collection

The gradiometer includes an on-board data-logger. Readings are taken along parallel traverses of one axis of a 20m x 20m grid. The traverse interval is 1.0m and readings are logged at intervals of 0.25m along each traverse. Marked guide ropes are used to ensure high positional accuracy during the high resolution survey. The data is transferred from the data-logger to a computer where it is compiled and processed using ArchaeoSurveyor2 software. The data is presented as a grey scale plot where data values are represented by modulation of the intensity of a grey scale within a rectangular area corresponding to the data collection point within the grid. This produces a plan view of the survey and allows subtle changes in the data to be displayed. This is supplemented by an interpretation diagram showing the main feature of the survey with reference numbers linking the anomalies to descriptions in the written report. It should be noted that the interpretation is based on the examination of the shape, scale and intensity of the anomaly and comparison to features found in previous surveys and excavations etc. In some cases the shape of an anomaly is sufficient to allow a definite interpretation e.g. a Roman fort. In other cases all that can be provided is the most likely interpretation. The survey will often detect several overlying phases of archaeological remains and it is not usually possible to distinguish between them. Weak and poorly defined anomalies are most 4 susceptible to misinterpretation due to the propensity of the human brain to define shapes and patterns in random background "noise". An assessment of the confidence of the interpretation is given in the text.

3.2.4 Data Processing

The data is presented with a minimum of processing although corrections are made to compensate for instrument drift and other data collection inconsistencies. High readings caused by stray pieces of iron, fences, etc. are usually modified on the grey scale plot as they have a tendency to compress the rest of the data. The data is however carefully examined before this procedure is carried out as kilns and other burnt features can produce similar readings. The data on some 'noisy' or very complex sites can benefit from 'smoothing'. Grey-scale plots are always somewhat pixellated due to the resolution of the survey. This at times makes it difficult to see less obvious anomalies. The readings in the plots can therefore be interpolated thus producing more but smaller pixels and a small amount of smoothing based on a low pass filter can be applied. This reduces the perceived effects of background noise thus making anomalies easier to see. Any further processing is noted in relation to the individual plot.

3.2.5 Aims

The report will include a discussion of the grey scale plot and an interpretation of the any anomalies identified; these anomalies will be presented as either positive or negative, suggesting whether they could be cut features (ditches, pits etc.), or built sub-surface features (e.g., banks). Figures will be included for the grey scale plot and for the anomaly interpretation. The results of the geophysical survey will be used to inform further recommendations for archaeological evaluation and/or mitigation (if relevant)

3.3 Report compilation

Following completion of the stages outlined above, a report will be produced incorporating the following:

1. Front cover;
2. Inner cover;
3. Figures and Plates List;
4. Non-technical summary (Welsh/English);
5. Introduction;
6. Methodology;
    i. Geophysical survey;
7. Results;
8. Conclusions and recommendations;
    a. Conclusion and recommendations;
9. Acknowledgements;
10. Bibliography;
    a. Primary sources;
    b. Secondary sources;
11. Figures; inc.:
    - location plan;
    - grey scale plot;
    - anomaly identification and interpretation;
12. Appendix I (approved written scheme of investigation);
13. Appendix II (Sites listed on GAT Historic Environment Record);
14. Appendix III (Definition of mitigation terms);
15. Back cover.

Illustrations will include plans of the location of the study area; historical maps, when appropriate and if copyright permissions allow, will be included.

A full archive including plans, photographs, written material and any other material resulting from the project will be prepared. The archaeological evaluation outlined in this written scheme of investigation will be submitted in draft format in April 2020; a final report will be submitted to the Historic Environment within six months of submitting the draft report.

The following dissemination will apply:

- A digital report(s) will be provided to the client/consultant and GAPS (draft report then final report);
- A paper report plus a digital report will be provided to the regional Historic Environment Record, Gwynedd Archaeological Trust; this will be submitted within six months of project completion (final report only), along with any relevant, digital

information such as the project database and photographs. All digital datasets submitted will conform to the required standards set out in *Guidance for the Submission of Data to the Welsh Historic Environment Records (HERs)* (Version 1.1); and

- A digital report and archive (including photographic and drawn) data will be provided to Royal Commission on Ancient and Historic Monuments, Wales (final report only), in accordance with the *RCAHMW Guidelines for Digital Archives Version 1*. Digital information will include the photographic archive and associated metadata.

4 PERSONNEL

The project will be managed by John Roberts, Principal Archaeologist GAT Contracts Section. The survey will be completed by *Sumo Surveys* who will have responsibility for completing and compiling the survey data, interpreting the results and preparing the subsequent report. The project manager will be responsible for reviewing and approving the report prior to submission and preparing the overall project for archive.

5 INSURANCE

5.1 Public/Products Liability

Limit of Indemnity- £5,000,000 any one event in respect of Public Liability
INSURER Aviva Insurance Limited
POLICY TYPE Public Liability
POLICY NUMBER 24765101CHC/UN/000375
EXPIRY DATE 21/06/2020

5.2 Employers Liability

Limit of Indemnity- £10,000,000 any one occurrence.
The cover has been issued on the insurers standard policy form and is subject to their usual terms and conditions. A copy of the policy wording is available on request.
INSURER Aviva Insurance Limited
POLICY TYPE Employers Liability
POLICY NUMBER 24765101 CHC / UN/000375
EXPIRY DATE 21/06/2020

5.3 Professional Indemnity

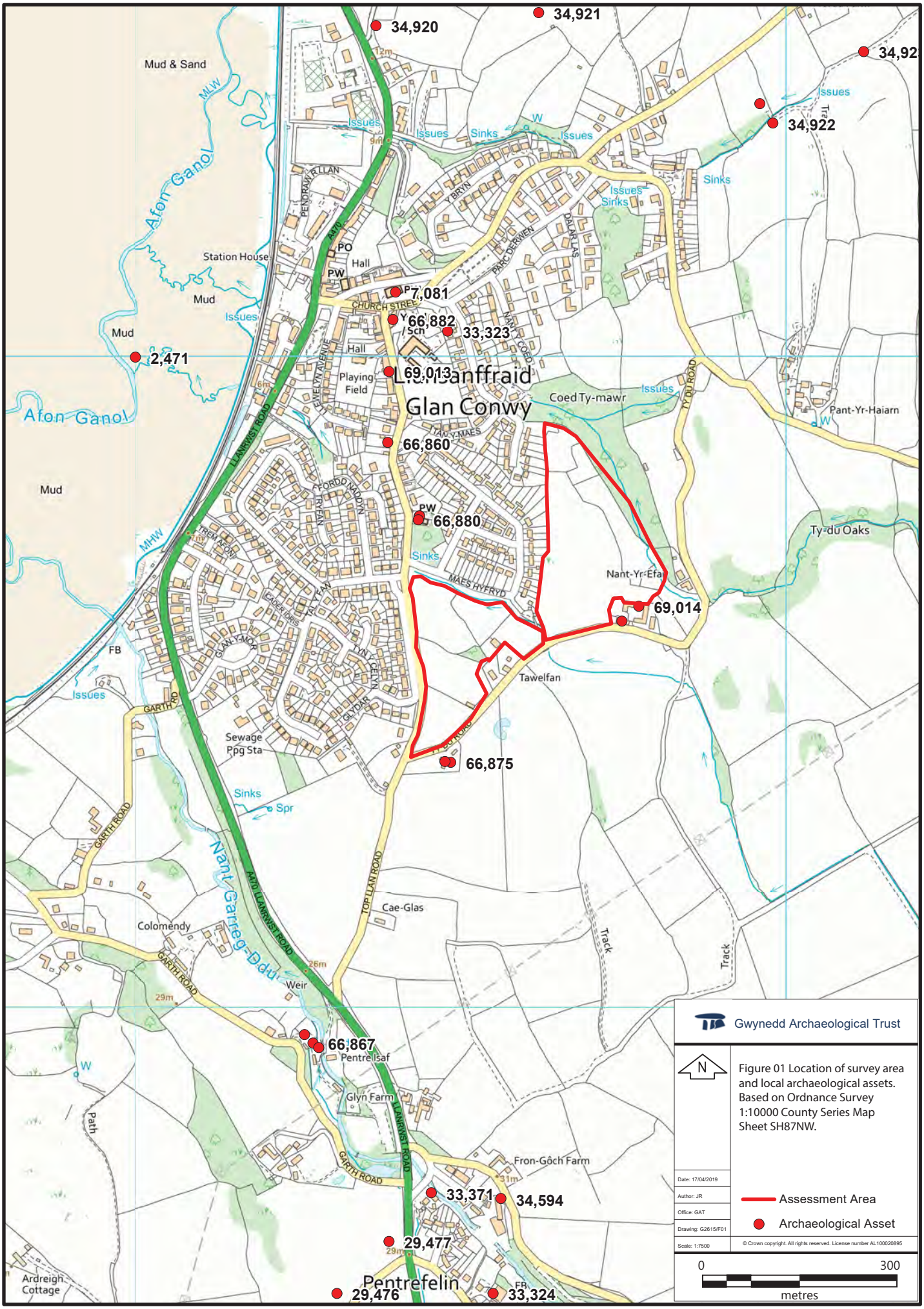
Limit of Indemnity- £5,000,000 in respect of each and every claim
INSURER Hiscox Insurance Company Limited
POLICY TYPE Professional Indemnity
POLICY NUMBER 9446015
EXPIRY DATE 22/07/2020

6 SOURCES CONSULTED

1. English Heritage, 1991, Management of Archaeological Projects
2. English Heritage, 2015, Management of Research Projects in the Historic Environment (MoRPHE).
3. *Guidance for the Submission of Data to the Welsh Historic Environment Records (HERs)* (Version 1.1)
4. Royal Commission on Ancient and Historic Monuments of Wales 2015 *Guidelines for digital archives*
5. Ryan Young, C. 2019. *Land off Ty Du Road, Glan Conwy Archaeological Assessment*. Gwynedd Archaeological Trust Report 1493.
6. Standard and Guidance for Archaeological Geophysical Survey (Chartered Institute for Archaeologists, 2014).

FIGURE 01

Location of survey area and local archaeological assets. Based on Ordnance Survey 1:10000 County Series Map Sheet SH87NW.


34,920
34,921
34,92
34,922
7,081
66,882
33,323
69,013
66,860
66,880
69,014
66,875
66,867
33,371
34,594
29,477
29,476
33,324
2,471
Llanffraid Glan Conwy
Coed Ty-mawr
Pant-Yr-Haiarn
Ty-du Oaks
Nant-Yr-Efa
Tawelfan
Cae-Glas
Colomendy
Pentrelsaf
Glyn Farm
Fron-Gôch Farm
Pentrefelin
Ardreigh Cottage
Sewage Ppg Sta
Station House
Playing Field
Afon Ganol
Nant Garreg-Ddu
Mud & Sand
Mud
Issues
Sinks
Weir
Track
Path
Gwynedd Archaeological Trust
N
Figure 01 Location of survey area and local archaeological assets. Based on Ordnance Survey 1:10000 County Series Map Sheet SH87NW.
Date: 17/04/2019
Author: JR
Office: GAT
Drawing: G2615/F01
Scale: 1:7500
Assessment Area
Archaeological Asset
© Crown copyright. All rights reserved. License number AL100020895
0
300
metres

Gwynedd Archaeological Trust
Ymddiriedolaeth Archaeolegol Gwynedd

Craig Beuno, Ffordd y Garth, Bangor, Gwynedd. LL57 2RT
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