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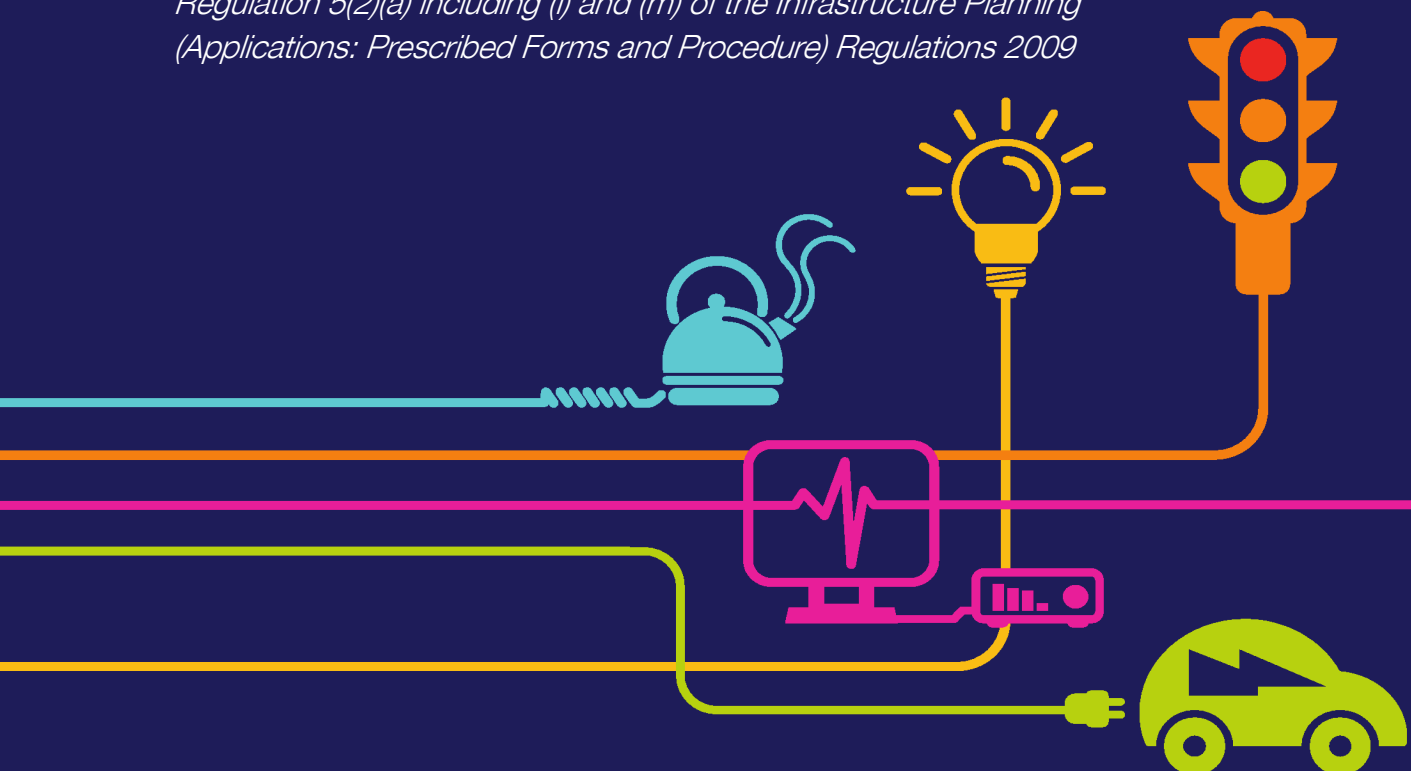
(Part 1 of 8)

# Geophysical Survey Report

## Chapter 10 – Appendix 2

National Grid (North Wales Connection Project)

*Regulation 5(2)(a) including (l) and (m) of the Infrastructure Planning  
(Applications: Prescribed Forms and Procedure) Regulations 2009*





# **North Wales Connection Project**

## **Volume 5**

### **Document 5.10.2.2 Appendix 10.2 Geophysical Survey Part 1**

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**WYAS**  
**Archaeological  
Services**

**North Wales Connection Project  
Anglesey and Gwynedd  
Wales**

**Geophysical Survey**

Report Number: 2982

June 2017

**Client:** National Grid



**West Yorkshire Joint Services**

# **North Wales Connection Project, Anglesey and Gwynedd, Wales**

## **Geophysical Survey**

### *Summary*

*A geophysical (magnetometer) survey, following the course of a proposed new grid connection (North Wales Connection Project) was undertaken in 102 survey areas across Anglesey and Gwynedd. This was part of a programme of archaeological works. Throughout the survey areas, significant geological magnetism has been detected. Similarly, prominent former field boundaries, with a distinctive magnetic feature have been identified. Within the survey areas, magnetic disturbance and ferrous material has been recorded. Along the route, possible archaeology has been identified. Anomalies with an archaeological origin have been detected predominantly in Sections C-E of the scheme and include enclosures and field systems. Therefore the archaeological potential of the survey scheme is considered to be moderate across the island, with high potential within the central core of the island.*



## Report Information

Client: National Grid  
Address: 1-3 Strand, London WC2N 5EH  
Report Type: Geophysical Survey  
Location: Anglesey  
County: Anglesey and Gwynedd  
Grid Reference: Section A: SH 3586 9276 – SH 4114 8946  
Section B: SH 4114 8946 – SH 4429 8502  
Section C: SH 4429 8502 – SH 4843 7711  
Section D: SH 4843 7711 – SH 5115 7435  
Section E: SH 5115 7435 – SH 5198 7098  
Section F: SH 5429 6876 – SH 5644 6686  
  
Period(s) of activity: Prehistoric?/Medieval/ modern  
Report Number: 2982  
Project Number: 6536  
Site Code: ALS17  
Date of fieldwork: January to April 2017  
Date of report: June 2017  
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## 1 Introduction

Archaeological Services WYAS (ASWYAS) were commissioned by Mike Glyde of Amec Foster Wheeler (AmecFW), on behalf of their client Graham Dennison-Smith of National Grid (the Client), to undertake a geophysical (magnetometer) survey within agreed survey areas extending from Wylfa on the Isle of Anglesey, southwards towards the Pentir sub-station on the mainland in Gwynedd. This was undertaken as part of the archaeological assessment of the proposed North Wales Connection (NWC) project for the creation of a new grid connection for the planned Wylfa nuclear power station. Guidance contained within the National Planning Policy Framework (DCLG 2012) was followed, in line with current best practice (CIfA 2014; David *et al.* 2008). The survey was carried out between 18th January and 7th April 2017.

### Site location, topography and land-use

The proposed route of the upgraded capacity pylons for the planned nuclear power station at Wylfa extends for c.33km from Cemaes Bay on the northeast coast of the island of Anglesey to Pentir which is 5km to the southwest of Bangor on the mainland. For ease of interpretation the route has been divided into six sections, (Figures 1-7 and Table 1).

The landscape is an undulating one, dominated by hills and hillocks, primarily running through the centre of the island along a northeast – southwest alignment. There are also a number of dominant schist and quartzite outcrops, which dominate the enclosed fields in which they protrude. The land use is characterized by improved grassland, primarily used for pastoral grazing.

SECTION	NAME	AREA	FIGS
	Overviews		1 - 7
Section A	Wylfa to Rhosgoch	102 to 84	8 - 64
Section B	Rhosgoch to Llandyfrydog	83 to 64	65- 109
Section C	Llandyfrydog to North of Talwrn	63 to 34	110 - 184
Section D	North of Talwrn to Ceint	33 to 27	185 - 208
Section E	Ceint to Afon Braint	26 to 10	209 - 253
Section F	Afon Braint to Pentir	9 to 1	254 - 271

Table 1: Sections and related figures and area numbers

## **Soils and geology**

The bedrock geology comprises a complex collage of igneous, sedimentary and metamorphic rocks that were formed 300–650 million years ago.

The NWC route within Anglesey traverses across multiple marked bedrock and lithological landform morphologies. These changes are believed to have been locally controlled by large-scale faults and/or major lithological boundaries within the bedrock (BGS 2017). As a result, these specific differences in geology relay changes in magnetic responses, observed in geophysical results, as outlined below.

The survey results from within the southern section of the NWC route, within Gwynedd, show considerable indications of geological influences in geophysical data. This area contains a large proportion of igneous bedrock belonging to the Padarn Tuff formation (BGS, 2017) and there are exceedingly high levels of background noise present as a result. Igneous geology parents tend to be problematic owing to their thermo-remnant magnetism, generating large amounts of background noise (Gaffney and Gater, 2003). These high levels leads to a more difficult interpretation of the data collected.

Additionally it is also important to consider the soil thickness present throughout the area. A thinner level of soil above the igneous bedrock will again lead to higher levels of background noise than that of an area with thicker layers of soil.

## **2 Archaeological Background**

Evidence of occupation of the Isle of Anglesey has been identified from as early as the Neolithic period, although due to later agricultural practices, evidence of these early periods of occupation are often limited to marginal land or to only the largest monument types; such as megalithic tombs and standing stones. Settlement archaeology from the Neolithic and Bronze Age left little visible evidence on the landscape. From the Iron Age onward dense settlement of the island can be identified, represented by large hillforts, enclosed settlements and more unusually unenclosed stone roundhouses. From the Iron Age and Romano-British period throughout the medieval period the landscape was intensively farmed, both pastoral and arable farming took place, but the modern landscape is now dominated by pasture.

During the early medieval period the Celtic church began to flourish and two monasteries were established on the island; St Cybis and St. Seiriols. These, along with other early Christian sites, including the parliament at Aberffraw, were destroyed by Viking raiders who failed to form any significant settlements on the island.

From the early 18th century onwards copper mining was also an important part of the exploitation of the Anglesey landscape, at Amlwch the Parys Mountain was mined for copper

until the early 20th century, with evidence also being uncovered for mining as early as the Bronze Age, as well as Roman emblazoned copper ingots.

### **3 Aims and Methodology**

The main aim of the geophysical survey was to provide sufficient information to enable an assessment to be made of the impact of the development on potential sub-surface archaeological remains and for further evaluation or mitigation proposals, if appropriate, to be recommended. To achieve this aim, a magnetometer survey covering all amenable parts of the agreed survey area was undertaken:

The general objectives of the geophysical survey were:

- to provide information about the nature and possible interpretation of any magnetic anomalies identified;
- to therefore determine the presence/absence and extent of any buried archaeological features; and
- to prepare a report summarising the results of the survey.

#### **Magnetometer survey**

The site grid was laid out using a Trimble VRS differential Global Positioning System (Trimble 5800 model). The survey was undertaken using Bartington Grad601 magnetic gradiometers. These were employed taking readings at 0.25m intervals on zig-zag traverses 1.0m apart within 30m by 30m grids, so that 3600 readings were recorded in each grid. These readings were stored in the memory of the instrument and later downloaded to computer for processing and interpretation. Geoplot 3 (Geoscan Research) software was used to process and present the data. Further details are given in Appendix 1.

#### **Reporting**

A general site location plan, incorporating the 1:50000 Ordnance Survey (OS) mapping, is shown in Figure 1. Figure 2 shows an overview of Section A at a scale of 1:20,000. Figure 3 shows an overview of Section B at the same scale. Section C (Figure 4) is unscaled, however Figures 5 and 6, show an overview of Section D and E respectively at 1:20,000. Finally Figure 7, displays an overview of Section F at a scale of 1:10000. The processed and minimally processed data, together with an interpretation of the survey results are presented in Figures 8 to 271 inclusive at a scale of 1:1000.

Technical information on the equipment used, data processing and survey methodologies are given in Appendix 1. Technical information on locating the survey area is provided in

Appendix 2. Appendix 3 describes the composition and location of the archive. Appendix 4 consists of a table of the anomalies throughout the scheme.

The survey methodology, report and any recommendations comply with guidelines outlined by English Heritage (David *et al.* 2008) and by the Chartered Institute for Archaeologists (CIfA 2014). All figures reproduced from Ordnance Survey mapping are with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

*The figures in this report have been produced following analysis of the data in processed formats and over a range of different display levels. All figures are presented to most suitably display and interpret the data from this site based on the experience and knowledge of Archaeological Services staff.*

## **4 Results and Discussion (see Figures 8 to 271)**

A comprehensive table of the findings for each area is given in Appendix 4. Discussion will generically describe each type of anomaly across the whole scheme. Where appropriate, further, more detailed discussion will take place. For the possible archaeology and archaeological anomalies, a reference table for each will be given and any significantly notable features will be discussed in relation to the archaeological background and other landscape features.

### **Ferrous anomalies**

Ferrous anomalies, as individual 'spikes', or as large discrete areas are typically caused by ferrous (magnetic) material, either on the ground surface or in the plough-soil. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation, as modern ferrous debris or material is common on rural sites, often being present as a consequence of manuring or tipping/infilling. There is no obvious pattern or clustering to their distribution in this survey to suggest anything other than a random background scatter of ferrous debris in the plough-soil.

### **Geological anomalies**

The NWC route within Anglesey traverses across multiple marked bedrock and lithological landform morphologies. These changes are believed to have been locally controlled by large-scale faults and/or major lithological boundaries within the bedrock (BGS 2017). As a result, these specific changes in geology relay changes in magnetic responses, observed in geophysical results, as outlined below.

Areas 22-10, (Section E, Figs 209-253) illustrate relatively quiet levels of background noise, whilst containing discrete areas of clear, high magnitude geological responses. These geological responses are believed to have been as a result of metamorphic rock present across

a predominantly sedimentary based area. Here the lack of igneous conditions have generated a much cleaner data set. The data represented here is similar to those recorded at the very end of the scheme. Areas 102-86, (Section A, Figs 8-64) also contain much cleaner data with clear contrasts between possible archaeology, agriculture and areas of high magnitude geological responses related to the Metasedimentary bedrock present.

Areas 23-40, (Section C to Section E, Figs 110-253) consist predominantly of sedimentary rocks formed in deep seas, with a variety of undifferentiated metamorphic rock positioned across the survey area. The resulting data from the sites surveyed are relatively clear and contain little background noise. However, further northwest along the route the data becomes increasingly less clear as prominent igneous intrusions, outcrop through the shallow soils. This pattern is mirrored on the other side of the intrusion, following the scheme further northwest as the areas contain lower levels of background noise, until finally reaching Section A (Areas 86-102) where the geology reverts back to the Metasedimentary geology as previously mentioned above.

### **Agricultural anomalies**

Throughout the route, a number of agricultural anomalies have been identified. The more prominent double-ditched trackways have been identified, which are a repeated feature throughout the landscape and comparable examples can be seen in the landscapes of similar geology, notably Cornwall and Devon. They have not been given an archaeological identifier as they are a common feature in the landscape and relate to agricultural activity. The removal of such features is also indicative of the changes in agricultural practices. Some linear features of an agricultural origin, indicative of a form of ploughing, have been identified across the scheme.

### **Possible archaeological anomalies**

Possible archaeological anomalies are those which have magnetic anomalies which may be archaeological in origin. However, because of the noisy igneous geology or other modern disturbance activity, clear identification has been obscured. The magnetic response and XY trace plot is similar to that of anomalies with a geological origin and a possible archaeological interpretation has been made on the basis of relationships between other anomalies. Tabulated below are the identification numbers, the corresponding areas, figure numbers and their location within the NWC route. A thorough and in-depth discussion will be made with those considered to be of importance.

In order to differentiate between anomalies, those with possible archaeological origins, have been given the prefix P.

Possible Arch ID	Area	Fig. Numbers	Section
P1	92	32-43	A: Wylfa to Rhosgoch
P2	92	32-43	A: Wylfa to Rhosgoch
P3	92	32-43	A: Wylfa to Rhosgoch
P4	92	32-43	A: Wylfa to Rhosgoch
P5	92	32-43	A: Wylfa to Rhosgoch
P6	92	32-43	A: Wylfa to Rhosgoch
P7	91	41-43	A: Wylfa to Rhosgoch
P8	84	62-64	A: Wylfa to Rhosgoch
P9	83	65-67	B: Rhosgoch to Llandyfrydog
P10	80	71-73	B: Rhosgoch to Llandyfrydog
P11	79	74-76	B: Rhosgoch to Llandyfrydog
P12	78	77-79	B: Rhosgoch to Llandyfrydog
P13	76	80-82	B: Rhosgoch to Llandyfrydog
P14	74	86-88	B: Rhosgoch to Llandyfrydog
P15	72	89-91	B: Rhosgoch to Llandyfrydog
P16	68	98-100	B: Rhosgoch to Llandyfrydog
P17	67	101-103	B: Rhosgoch to Llandyfrydog
P18	65	107-109	B: Rhosgoch to Llandyfrydog
P19	58	113-115	C: Llandyfrydog to North of Talwrn
P20	58	113-115	C: Llandyfrydog to North of Talwrn
P21	57	116-118	C: Llandyfrydog to North of Talwrn
P22	57	116-118	C: Llandyfrydog to North of Talwrn
P23	56	119-121	C: Llandyfrydog to North of Talwrn
P24	56	119-121	C: Llandyfrydog to North of Talwrn
P25	55	122-124	C: Llandyfrydog to North of Talwrn
P26	54	125-127	C: Llandyfrydog to North of Talwrn
P27	53	128-130	C: Llandyfrydog to North of Talwrn
P28	52	131-133	C: Llandyfrydog to North of Talwrn
P29	51	134-136	C: Llandyfrydog to North of Talwrn
P30	50	137-139	C: Llandyfrydog to North of Talwrn
P31	49	140-142	C: Llandyfrydog to North of Talwrn
P32	47	146-148	C: Llandyfrydog to North of Talwrn
P33	47	146-148	C: Llandyfrydog to North of Talwrn
P34	46	149-151	C: Llandyfrydog to North of Talwrn
P35	43	158-160	C: Llandyfrydog to North of Talwrn
P36	41	164-166	C: Llandyfrydog to North of Talwrn
P37	41	164-166	C: Llandyfrydog to North of Talwrn
P38	41	164-166	C: Llandyfrydog to North of Talwrn
P39	39	170-172	C: Llandyfrydog to North of Talwrn



P40	39	170-172	C: Llandyfrydog to North of Talwrn
P41	35	182-184	C: Llandyfrydog to North of Talwrn
P42	33	185-190	D: North of Talwrn to Ceint
P43	33	185-190	D: North of Talwrn to Ceint
P44	29	200-202	D: North of Talwrn to Ceint
P45	28	200-205	D: North of Talwrn to Ceint
P46	28	200-205	D: North of Talwrn to Ceint
P47	27	206-208	D: North of Talwrn to Ceint
P48	26	209-211	E: Ceint to Afon Braint
P49	25	212-214	E: Ceint to Afon Braint
P50	22	221-223	E: Ceint to Afon Braint
P51	21	224-229	E: Ceint to Afon Braint
P52	13	242-244	E: Ceint to Afon Braint
P53	9	254-262	F: Afron Braint to Pentir
P54	1	266-268	F: Afron Braint to Pentir

*Table 2. Possible archaeological anomalies*

Magnetic responses which have been interpreted as burnt mounds (Area 92, Figs 32-43, Area 39, Figs 170-172 and Area 13, Figs 242-244) have been identified as only being of possible archaeological origin because of the similarity to the magnetic response of geological anomalies. Significantly and without exception, all of those anomalies identified as burnt mounds occur in low-lying, boggy parts of the survey area, close to geological outcropping, hence the possible archaeological interpretation. Area 80 (P10, Figs 71 - 73) has been given a possible archaeological interpretation, even though it is likely to be geological. However it has a similar arrangement to those above, and may form another area of burnt mound interest.

Area 79 (Figs 74-76), has a rectangular anomaly located in the top northwest corner of the area. The dimensions are approximately 20m x 20m and may have formed a structure which was demolished during the construction of the railway or road.

Within the noisy geological background of Area 67, a square feature has been interpreted (P18), however clear definition is difficult because of the increased background magnetism. It may be associated with other archaeological features in subsequent fields, however this is difficult to confirm.

It is highly likely that the pit-like features within the defined enclosure in Area 33, are archaeological (P42 and P43, Figs 185-190). As they are located in a prominent area of geological activity they have been interpreted as possibly archaeological in origin.

## Archaeology

The table below lists the archaeological features identified within the survey areas, whilst in-depth discussion below will focus on a selection of the more prominent and complete features.

In order to differentiate between anomalies, those with archaeological origins, have been given the prefix A.

Arch ID	Area	Fig. Numbers	Section
A1	83	68-70	B: Rhosgoch to Llandyfrydog
A2	72	89-91	B: Rhosgoch to Llandyfrydog
A3	65	107-109	B: Rhosgoch to Llandyfrydog
A4	63	110-112	C: Llandyfrydog to North of Talwrn
A5	58	113-115	C: Llandyfrydog to North of Talwrn
A6	53	128-133	C: Llandyfrydog to North of Talwrn
A7	50	137-139	C: Llandyfrydog to North of Talwrn
A8	50	137-139	C: Llandyfrydog to North of Talwrn
A9	43	158-160	C: Llandyfrydog to North of Talwrn
A10	41	164-166	C: Llandyfrydog to North of Talwrn
A11	39	170-172	C: Llandyfrydog to North of Talwrn
A12	37	176-178	C: Llandyfrydog to North of Talwrn
A13	35	182-184	C: Llandyfrydog to North of Talwrn
A14	34	182-184	C: Llandyfrydog to North of Talwrn
A15	33	185-190	D: North of Talwrn to Ceint
A16	29	200-202	D: North of Talwrn to Ceint
A17	28	200-205	D: North of Talwrn to Ceint
A18	28	200-205	D: North of Talwrn to Ceint
A19	27	206-208	D: North of Talwrn to Ceint
A20	26	209-211	E: Ceint to Afon Braint
A21	26	209-211	E: Ceint to Afon Braint

*Table 3. Archaeological anomalies*

The most prominent archaeological features can be seen in Areas 57-50 (Section C, A6 – A8, Figs 128 – 139). The magnetic features which have been detected suggest a systematic network of former field boundaries which underlie current field divisions.

Towards the end of section C, a change in the responses from a regular system of rectangular field systems, to circular enclosure responses which are situated on prominent high points within the landscape begin. Area 39 (A11, Figs 170-173) is such an example. A strong magnetic curving linear terminates at the change in landscape. To the south of this feature are a number of strong magnetic responses which are seen elsewhere in the route.

Within Area 33 (Section D, Fig 185-190) archaeological feature A15 is an egg-shaped enclosure, situated on a prominent change in the landscape measuring approximately 120m x 120m. The western point of the enclosure sits on the change of slope, into a valley. There is also evidence of earlier activity in this area, with a fainter linear feature underneath the enclosure.

The archaeological responses which have been detected in Areas 29 – 27 (Section D, Fig 200-205), revert to those similar in shape as previously seen in Areas 57 – 50.

***The results and subsequent interpretation of data from geophysical surveys should not be treated as an absolute representation of the underlying archaeological and non-archaeological remains. Confirmation of the presence or absence of archaeological remains can only be achieved by direct investigation of sub-surface deposits.***

## 5 Conclusions

Across the whole of the NWC route a variety of magnetic responses have been detected. There are clear geological responses at the northern termini of the route on Anglesey, where bands of geology prevail.

Agricultural anomalies have been identified throughout the survey areas and are predominantly associated with the former trackways and field boundaries of Anglesey. Comparisons can be drawn with similar types of anomalies in Cornwall and Devon.

Throughout the survey areas there is magnetic disturbance and ferrous material which is synonymous with wire fence boundaries and dumped material.

Possible archaeology has been detected across the whole of the island of Anglesey and into Gwynedd. Some of these anomalies may be agricultural as only part of a wider sub-soil feature has been detected. Similarly, where the strength of the feature is comparable to geological material and with a strong magnetic background, some clear definition is difficult. Burnt mounds have been located in previous archaeological investigations at the Wylfa end of the scheme, and there is the possibility that similar anomalies have also been detected.

Archaeological anomalies are prominently located within Sections B-E and take a variety of shapes from enclosures to large landscape divisions.

Overall the archaeological potential of the scheme is moderate, with high archaeological potential in Section C – E, mainly in areas 55-57, 33 and 29.

## **Appendix 1: Magnetic survey - technical information**

### **Magnetic Susceptibility and Soil Magnetism**

Iron makes up about 6% of the Earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haemetite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms. Areas of human occupation or settlement can then be identified by measuring the magnetic susceptibility of the topsoil because of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected. The magnetic susceptibility of a soil can also be enhanced by the application of heat and the fermentation and bacterial effects associated with rubbish decomposition. The area of enhancement is usually quite large, mainly due to the tendency of discard areas to extend beyond the limit of the occupation site itself, and spreading by the plough.

### **Types of Magnetic Anomaly**

In the majority of instances anomalies are termed 'positive'. This means that they have a positive magnetic value relative to the magnetic background on any given site. However some features can manifest themselves as 'negative' anomalies that, conversely, means that the response is negative relative to the mean magnetic background.

Where it is not possible to give a probable cause of an observed anomaly a '?' is appended.

It should be noted that anomalies interpreted as modern in origin might be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can therefore remove the feature causing the anomaly.

The types of response mentioned above can be divided into five main categories that are used in the graphical interpretation of the magnetic data:

*Isolated dipolar anomalies (iron spikes)*

These responses are typically caused by ferrous material either on the surface or in the topsoil. They cause a rapid variation in the magnetic response giving a characteristic 'spiky' trace. Although ferrous archaeological artefacts could produce this type of response, unless there is supporting evidence for an archaeological interpretation, little emphasis is normally given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring.

*Areas of magnetic disturbance*

These responses can have several causes often being associated with burnt material, such as slag waste or brick rubble or other strongly magnetised/fired material. Ferrous structures such as pylons, mesh or barbed wire fencing and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

*Linear trend*

This is usually a weak or broad linear anomaly of unknown cause or date. These anomalies are often caused by agricultural activity, either ploughing or land drains being a common cause.

*Areas of magnetic enhancement/positive isolated anomalies*

Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

*Linear and curvilinear anomalies*

Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

**Methodology: Gradiometer Survey**

The main method of using the fluxgate gradiometer for commercial evaluations is referred to as *detailed survey* and requires the surveyor to walk at an even pace carrying the instrument within a grid system. A sample trigger automatically takes readings at predetermined points, typically at 0.25m intervals, on traverses 1m apart. These readings are stored in the memory of the instrument and are later dumped to computer for processing and interpretation.

During this survey a Bartington Grad601 magnetic gradiometer was used taking readings on the 0.1nT range, at 0.25m intervals on zig-zag traverses 0.5m apart within 30m by 30m square grids. The instrument was checked for electronic and mechanical drift at a common point and calibrated as necessary. The drift from zero was not logged.

The gradiometer data have been presented in this report in processed greyscale format. The data in the greyscale images have been interpolated and selectively filtered to remove the effects of drift in instrument calibration and other artificial data constructs and to maximise the clarity and interpretability of the archaeological anomalies.

The results and subsequent interpretation of data from geophysical surveys should not be treated as an absolute representation of the underlying archaeological and non-archaeological remains. Confirmation of the presence or absence of archaeological remains can only be achieved by direct investigation of sub-surface deposits.

## **Appendix 2: Survey location information**

An initial survey station was established using a Trimble VRS differential Global Positioning System (Trimble 5800 model). The data was geo-referenced using the geo-referenced survey station with a Trimble RTK differential Global Positioning System (Trimble R6 model). The accuracy of this equipment is better than 0.01m. The survey grids were then super-imposed onto a base map provided by the client to produce the displayed block locations. However, it should be noted that Ordnance Survey positional accuracy for digital map data has an error of 0.5m for urban and floodplain areas, 1.0m for rural areas and 2.5m for mountain and moorland areas. This potential error must be considered if co-ordinates are measured off hard copies of the mapping rather than using the digital co-ordinates.

***Archaeological Services WYAS cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.***



### **Appendix 3: Geophysical archive**

The geophysical archive comprises:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Microsoft Word 2000), and graphics files (Adobe Illustrator CS6 and AutoCAD 2008) files; and
- a full copy of the report.

At present the archive is held by Archaeological Services WYAS although it is anticipated that it may eventually be lodged with the Archaeology Data Service (ADS). Brief details may also be forwarded for inclusion on the English Heritage Geophysical Survey Database after the contents of the report are deemed to be in the public domain (i.e. available for consultation in the Gwynedd Historic Environment Record).

## **Appendix 4: Table of anomalies**

Area Number	Description	Figs	Identifiers
Area 102	Geological bands of material, along with magnetic disturbance around the periphery of the field. A service runs through the middle of the site along a north - south alignment.		
Area 101	Geological bands, which form an unusual, rectangular type sub-surface feature.		
Area 100	Ferrous material and faint agricultural linears.		
Area 99	Magnetic disturbance.		
Area 98			
Area 97	Strong geological bands of igneous material, with evidence of double-ditched agricultural field boundaries/ trackways.		
Area 96	Geology and double-ditched agricultural field boundaries.		
Area 95	Geology and double-ditched agricultural field boundaries.		
Area 94	Geological bands and magnetic disturbance.		
Area 93	Geological bands and magnetic disturbance.		
Area 92	At the western end, there are strong geological bands of material which extend throughout Area 92. There is evidence of possible archaeology here. A series of possible burnt mounds within a prominent geological area have been detected and have similar magnetic responses to other features along the scheme. However they are close to known geological outcropping hence possible archaeology. P1 forms a rectangular type anomaly which is located in the north-western corner of Area 92 at its western edge. It may have formed an enclosure but it is given a possible interpretation because of the possible disturbance in the immediate west and north. P2 forms a pair of discrete linears which may have an association with P1. P3 is a circular anomaly, in a boggy landscape, with strong geological bands of material in the area. A drain passes through the anomaly which may be associated. P4 and P5 are within close proximity to one another. P4 sits within an area of boggy land, whilst P5 has similar characteristic. Both sit in an area where there are geological outcroppings and at the bottom of a slope. P6 is a pair of anomalies which are situated within an area which contains fragmentary field boundaries.	32-43	P1, P2, P3, P4, P5, P6
Area 91	Possible archaeology. A linear response which does not correspond with other features in detected. It may form part of a former field boundary	41-43	P7
Area 90	Geology.		
Area 89	Geology and field drains.		
Area 88	Magnetic disturbance.		
Area 87	Geology.		
Area 86	Geology.		
Area 85	Geology.		
Area 84	Possible archaeology. An inference can be detected in Area 84, however the underlying geology of the area makes definitive interpretation difficult. The landscape of the area is on a peak, and this may be a geological anomaly which has be shallower depths of soil in comparison to other parts of the field and overall scheme.	62-64	P8
Area 83	Evidence of archaeology with multiple ferrous magnetic disturbance across the survey area. Some evidence of double-ditched field boundaries and some possible archaeology. Strong geological responses where the landscape changes. A1 is short length of magnetic ditch fill, which broadly follows the same alignment as the service pipe which cuts through the site. The larger possible archaeological anomalies are located to the east of A1 and may be associated. A1 forms a series of possible ditch fills to create an area of enclosure. They have only been given possible archaeological origins, as they may be associated to the double-ditched trackways and field boundaries which occur throughout the scheme.	65-67	A1, P9
Area 82	Magnetic disturbance and geological deposits.		
Area 81	Geology and ferrous.		
Area 80	Area of disturbance, geology and a potential U-shaped enclosure which can be see in the ground and may be reflect the change in the landscape. It may be associated with the features to the east of the disused railway line which may have bisected the previous relationship.	71-73	P10
Area 79	Double-ditch trackway/ boundaries with geological responses and agricultural. Magnetic disturbance and possible archaeology in the northwest corner. It may have an association with P10. A significant portion of the disturbance will be related to the former railway line which passed to the west, the geology of the landscape and the magnetic disturbance from the existing pylon.	74-76	P11
Area 78	Within a confused landscape, yet within close proximity to a change in landscape, a circular anomaly can be detected in the data and may be archaeological in nature. However the magnetically busy sub-soil, may partial obscure any clarity.	77-79	P12
Area 77	Disturbance and geological anomalies.		
Area 76	Geology, Agricultural and possible archaeology in the form of a trend to the east of the survey area.	80-82	P13
Area 75	Geology, Magnetic disturbance and agricultural.		
Area 74	An area of possible archaeology and some geological anomalies. They have been given possible archaeological origins as they are in slightly different alignment to the identified former field boundaries.	86-88	P14
Area 73	Geology.		
Area 72	A triangular feature which contains a circular anomaly within it has been detected. In strong association is P15 which may be associated with A2.	89-91	A2, P15
Area 71	Double-ditched trackway/field boundary and geology.		
Area 70			
Area 69	Magnetic disturbance and geology.		
Area 68	Geology and magnetic disturbance and possible archaeology in the form of a possible enclosure. It may have association with the possible archaeology in the adjacent field to the east.	98-100	P16
Area 67	A noisy field geologically, however possible archaeology has been detected within the middle of the field. It forms a square type of enclosure and internal divisions, on a different alignment to the existing field boundaries.	101-103	P17
Area 66	Geology and magnetic disturbance.		

Area 65	A magnetic linear feature has been detected aligned on an approximate northeast to southwest axis and appears to enclose a space. Geological anomalies and magnetic disturbance. A3 forms a field boundary, in conflict, to that of the existing field boundaries and contained to the immediate outside of the boundary curve, a possible archaeological anomaly has been detected. It has only been given a possible archaeological origin as it may be associated with the removal of A3.	107-109	A3, P18
Area 64			
Area 63	A number of linears used to define space in a quieter part of the survey scheme. They appear to form former field boundaries, different to those identified as agricultural with a distinct separation between the two.	110-112	A4
Area 58	A linear feature, most likely to be a field boundary, in contrast to the existing field boundaries have been detected. Within the area some potential anomalies have been identified (P19) which may be associated to the archaeological boundary. Similarly to the south, P20 has been identified which has only been detected in part, and so a tentative interpretation is given.	113-115	A5, P19, P20
Area 57	Double-ditched trackways/ field boundaries and strong geological bands in the data with possible archaeology in the area.	116-118	P21, P22
Area 56	Double-ditched trackways/ field boundaries and strong geological bands in the data. Evidence of possible archaeology and a service pipe which runs west to east. The northeast corner of this field has a linear which may be an earlier phase of field boundary. P24, to the south has a slightly different alignment and has been given a possible interpretation however it is close to areas of geology, hence a possible archaeological origin has been given.	119-121	P23, P24
Area 55	Evidence of possible archaeology along the western boundary of the field. A service pipe which runs west to east. There is evidence of field drains which originate from an area of hardstanding in the field.	122-124	P25
Area 54	Area of a standing stone. Magnetic disturbance from house building and road construction. There may be an association between the faint linears and the standing stone. The small survey area and the disturbance from the road and buildings makes definitive interpretation difficult.	125-127	P26
Area 53	Neolithic field system, characterised by a number of magnetic linears orientated on a broad north-south orientation A6. Within this busy landscape there are double-ditched trackways and boundaries and possible archaeological anomalies. These anomalies are divided by established current field boundaries yet underlie them and ergo predate them.	128-133	A6, P27
Area 52	A continuation of the field boundaries characterised above and a series of fragmented anomalies which may be possibly archaeological in origin.	131-133	A6, P28
Area 51	An east-west linear anomaly which slopes towards the east and forms a field boundary. A series of possible anomalies have been detected within the area of anomalies which are characterised as agricultural.	134-136	P29
Area 50	Within this parcel of land, two striking linears have been identified as archaeological in nature because of their orientation in contrast to the existing boundaries. Within this area are a small collection of anomalies which have been grouped as possible archaeology as a results of their relationship to A8.	137-139	A7, A8, P30
Area 49	Largely sterile of anomalies, the majority are considered to be geological in origin, however a series of anomalies along the western extent of the survey area, have been given a possible archaeological origin because of the length and almost deliberate nature of their alignment.	140-142	P31
Area 48	Geological and some ferrous.		
Area 47	A distinct pair of enclosures aligned on an east-west alignment, in contrast to the field system in Area 53. They have been given a possible interpretation because of the regularity which may be part of later agricultural activity. A pair of anomalies along the western boundary are associated with the possible anomalies of the field boundaries and trackways of fields to the north. Also within this area anomalies with a geological origin.	146-148	P32, P33
Area 46	A predominantly geological collection of anomalies, which may have possible archaeological anomalies within it, however they are difficult to differentiate, in comparison to the linear of possible archaeological origin in the northwest corner of the survey area. Also within the area of geology, clear double-ditch trackways and field systems have been detected.	149-151	P34
Area 45	Geology.		
Area 44	Geology.		
Area 43	Field drains with part of a service pipe in the east has been detected. To the west of the survey area, a portion of a larger anomaly has been detected. Given the shape of the anomaly it has been given a possible archaeological origin because the extent and form of the larger feature can not be determined.	158-160	A9, P35
Area 42	Geology.		
Area 41	A distinct series of linears which could create habitation space. Within these areas, magnetic anomalies of possible archaeological origin, have also been recorded as they may be associated to the defined spaces. Geological anomalies have been detected within the survey area however they may also have possible archaeological origins.	164-166	A10, P36, P37, P38
Area 40	Geology and magnetic disturbance.		
Area 39	Archaeology and possible archaeology in the form of burnt mounds, similar to those found at Wylfa. Only given a possible archaeology as they have a similar magnetic signature to geological material. The defined archaeological space, sits within an area of high ground, in relation to the boggy, free-draining area below. Possible archaeological anomalies within the defined area of A11, have also been given possible archaeological origin because of their location, internally, with A11.	170-172	A11, P39, P40
Area 38	Almost sterile, quiet background because of the deep and uniform soils of the area. No archaeology.		
Area 37	Magnetic disturbance and geology. A series of archaeological anomalies have been identified based upon the orientation of the linears in contrast to the field boundaries.	176-178	A12
Area 36	Geology and magnetic disturbance caused by the pylon.		
Area 35	Double-ditched trackway/ field boundaries with A13 bisecting the boundary. It is likely to contain information which will be useful in determining the relationship between the two anomalies. A linear, on a different alignment from that of the field boundary and the archaeological linear has been interpreted as possible archaeology.	182-184	A13, P41
Area 34	Double-ditched trackway/ field boundaries with geological and ferrous anomalies. The double ditch trackway may have an association with P41, whilst A14 mirrors the orientation of A13.	182-184	A14
Area 33	Archaeological enclosure atop a natural occurring outcrop. A potential relationship with the anomalies in Area 34. Double-ditched trackways/ field boundaries along with prominent geological anomalies and some ferrous responses. Within the enclosure possible anomalies, which may refer to pits have been identified (P43), however the position of the slope and therefore the thinner soils, may mean that these anomalies are geological in origin. A linear feature is also seen to run within the enclosure and is likely to be archaeological in origin.	185-190	A15, P42, P43
Area 32	Geological anomalies and some agricultural responses. Possible archaeology relating to those listed above.		
Area 31	Geological and agricultural.		

Area 30	Geology.		
Area 29	Part of the field system which continues in Area 28. Geology. P44 located in Area 29, immediate above Area 28, is considered to be an area of possible archaeological origin, rather than archaeological, because of the fragmentary responses that were detected rather than the clearer and more responsive of those in Area 28.	200-202	A16, P44
Area 28	Field boundaries and trackways. A possible smaller enclosure in an area defined as a field boundary. A service pipe on an northwest to south southeast axis has been detected in the southern aspect of the area. The archaeological responses which have been detected in Areas 29, 28 and 27, (A16-19) which form part of a larger field network. These linear positive anomalies revert to those similar in shape as previously seen in Areas 57 – 50. A17, located at the northern end of Area 28, appears to have a series of magnetic responses which sub-divide the strip fields, which project from the western boundary of the field towards the east. These strip fields may relate to a former settlement which may have located to the east of the town of Llangefni. The magnetic features that are detected in Area 28, become less prominent in the south of the area, where more geological responses have been found, when the field begins to level towards the stream which runs along the eastern edge.	200-205	A17, A18, P45, P46
Area 27	A service, geology and possible archaeological anomalies, with a potential relationship with the archaeology on Area 28 and Area 26. A linear orientated approximately southwest to northeast may form a boundary to the anomalies identified in A28. Two possible anomalies may form part boundaries to the east of A19 however, they may have a relationship to the agricultural trends identified.	206-208	A19, P47
Area 26	Part of a field system and a curvilinear response interpreted as archaeological because of its different orientation to those around it. To the north of the survey area a series of linear forming a field system (A20) have been detected. Two anomalies have been detected within this feature and have been identified as possible archaeology (P48) and maybe pit-like. A change in the landscape (A21) may form part of a larger inter-dependent field system network. It is approximately 60m in length, orientated along an east-west axis, curving at the western extent.	209-211	A20, A21, P48
Area 25	Geology and possible archaeology in the form of a rectangular boundary. This may appears to create an internal space which is different from the geological anomalies which occur within the area.	212-214	P49
Area 24	Ferrous and geology.		
Area 23	Ferrous and geology.		
Area 22	Geology and ferrous and possible archaeology. The possible archaeology surrounds a highly magnetic anomaly, which may have an archaeological origin, however it is unclear the relationship between the two and therefore may be geological owing to the amount of geology in the area.	221-223	P50
Area 21	Geology and double-ditched trackways and field boundaries and possible archaeological anomalies which are distinct from the identified field boundaries. Similarly some circular trends may be inferred from the same feature.	224-226	P51
Area 20	Geology.	227-229	P51
Area 19	Geology.		
Area 18	Geology.		
Area 17	Geology.		
Area 16	Geology.		
Area 15	Geology.		
Area 14			
Area 13	Area 13 is a parcel of land within the Ceint to Afon Braint section of the scheme. Very little definitive archaeological material has been identified in this area, however some anomalies of possible archaeology have been identified. These possible archaeological anomalies (P52) origins can have similar magnetic responses in the XY trace plot to those of a geological origin. These anomalies have a form which is similar to those of burnt mounds, as seen in another part of the scheme (Area 38), however it is smaller and less condensed as in other parts of the scheme.	242-244	P52
Area 12	Ferrous and geology.		
Area 11	Geology.		
Area 10	A parcel of land on Anglesey which measures approximately five hectares and located within the Ceint to Afon Braint section of the scheme. A linear feature bisects the field on a southwest to northeast alignment. From this, a number of “spurs” have been identified which lead to this linear, indicating that it may be a field drain. This is further re-enforced as a regular number of magnetic responses form a herring bone type of arrangement, which again feeds into the linear across the scheme, but is typical of field drain responses. A number of ferrous magnetic responses have been identified across the site, along with significant bands of geological material which are predominantly in the northeast and northwest corners of the field, close to visible geological outcropping.		
Area 9	Trackway, geology and massive disturbance.		
Area 8	Geology and ferrous.		
Area 7	Some double-ditched trackways to the west and some possible archaeology (P53) Close to Pentir, Area 7 was pastoral land, which slopes from the north, into a valley to the south. It contained a number of anomalies which have been deemed to be geological in nature, with part of the area to the west showing part of a double-ditched trackway and enclosure which can be seen across the entire scheme. These have been given an agricultural interpretation, as they are clear and understandable features. Throughout the area there are linear trends which considered to be possible archaeology based on the strength and orientation to other magnetic responses. The anomalies (P53) shadow the agricultural trackways and boundaries, but they are a significant size in comparison to and may form part of a division, which is unassociated with the agricultural anomalies.	257-260	P53
Area 6	Geology and ferrous.		
Area 5	Geology and ferrous.		
Area 4	Geology and ferrous.		
Area 3	Geology and ferrous.		
Area 2	Geology and ferrous with some agricultural trends.		
Area 1	Double-ditched trackway. Magnetic disturbance. A linear which is of a different alignment to the existing boundaries has been identified, however it is likely that this may be a geological trend which follows the underlying bedrock of the field.	266-268	P54

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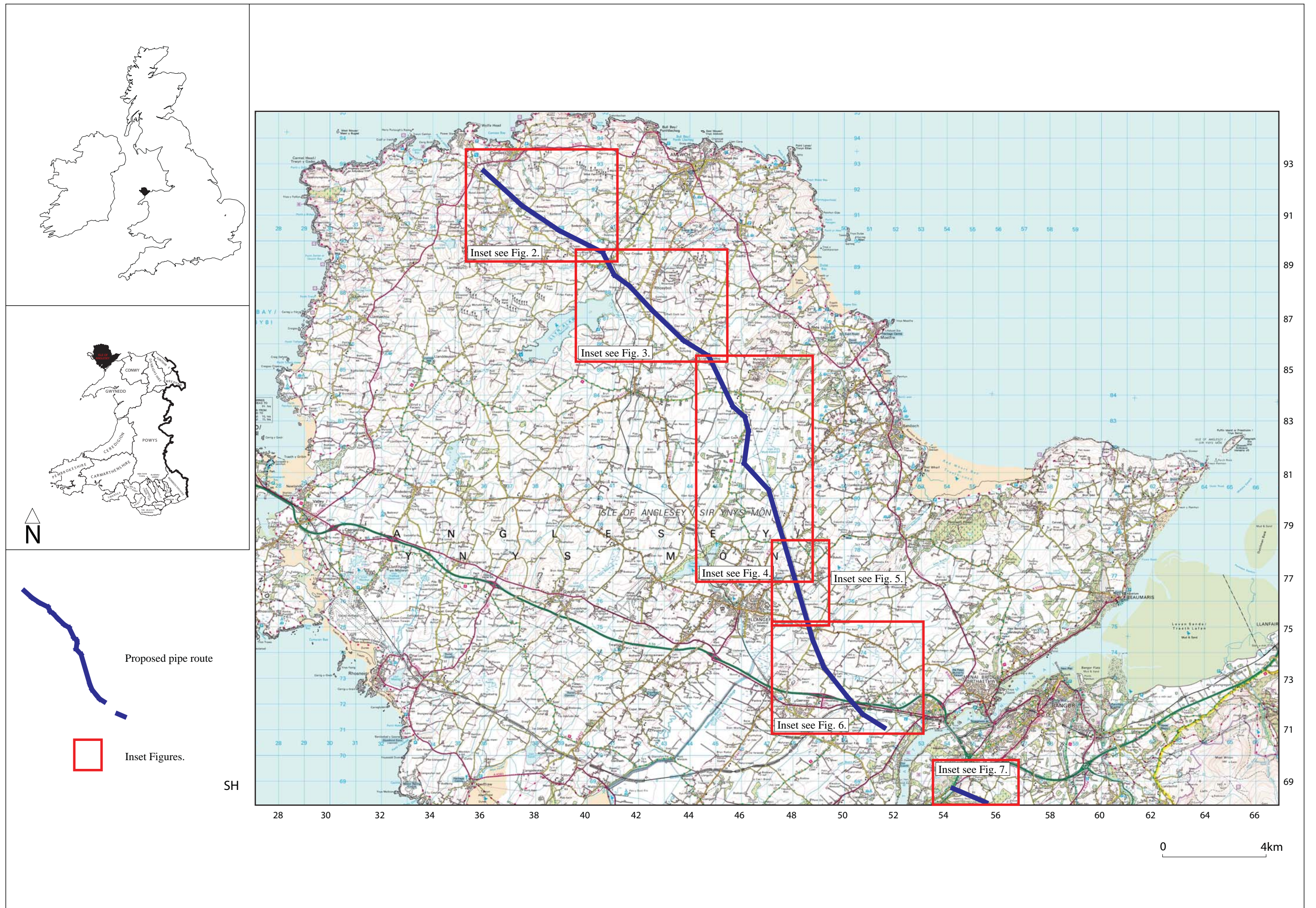


Fig. 1. Site location



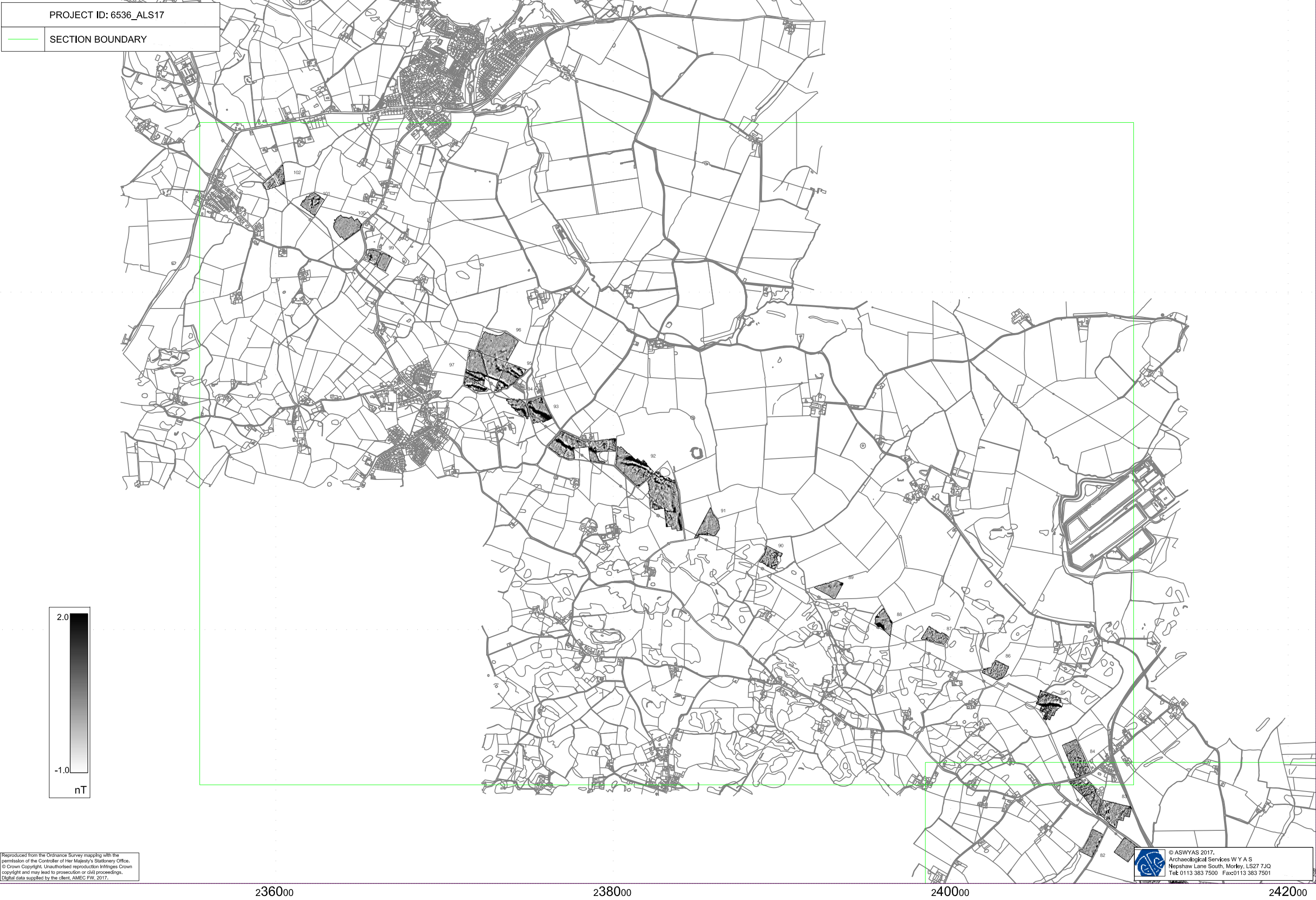


Fig. 2. Section A - Wylfa to Rhosgoch (1:20,000 @ A3)





Fig. 3. Section B - Rhosgoch to Llandyfrydog (1:20,000 @ A3)

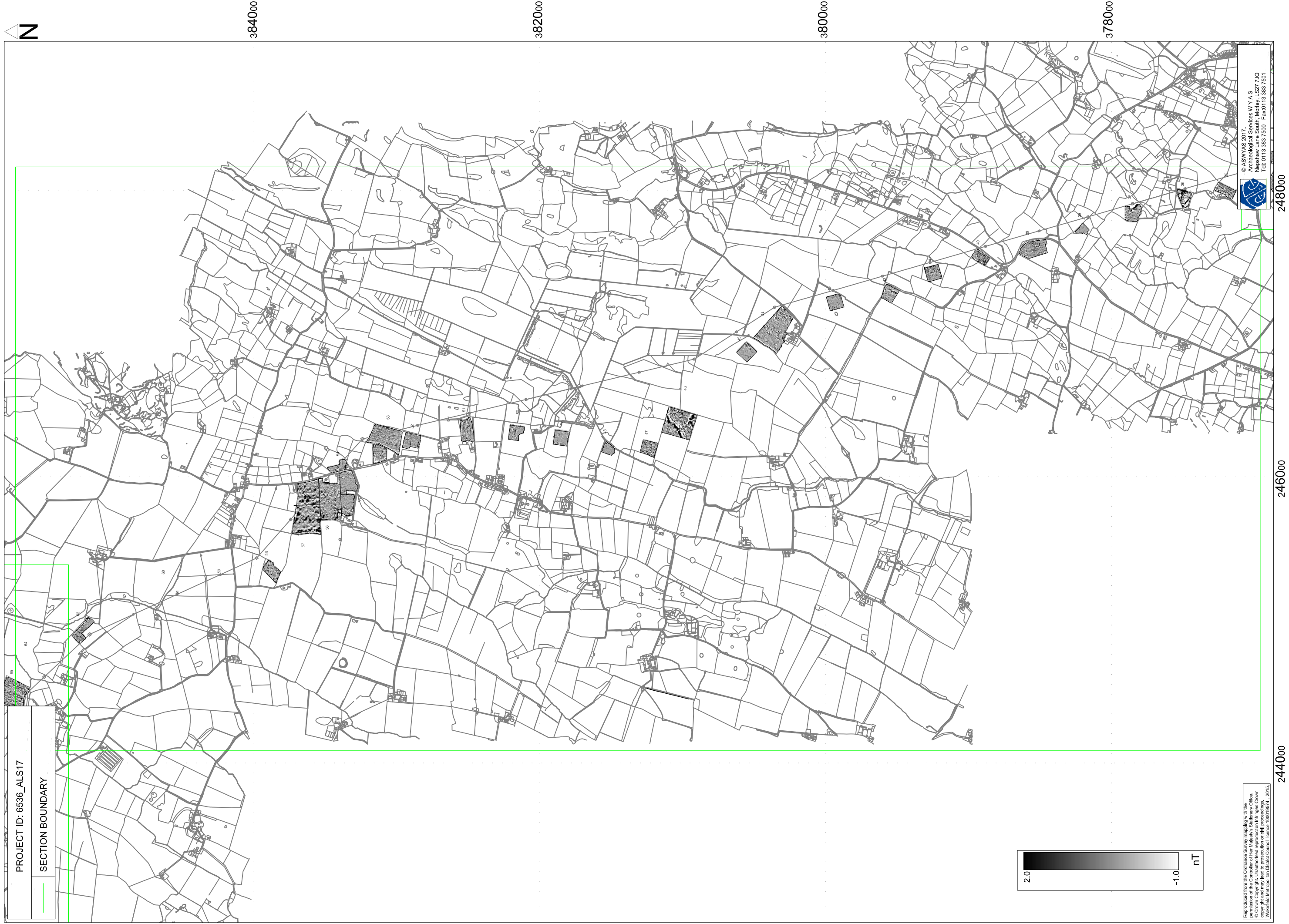


Fig. 4. Section C - Llandyfrydog to North of Talwrn (not to scale @ A3)







Fig. 6. Section E - Ceint to Afon Braint (1:20000 @ A3)





Fig. 7. Section F - Afon Braint to Pentir (1:10,000 @ A3)