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A487 New Dyfi Bridge

Environmental Statement
- Volume 3: Appendix 7.1

Geophysical Survey Report

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GEOPHYSICAL SURVEY REPORT

STRATASCAN™



Project name:

A487 Machynlleth, Powys

Client:

Arup Consulting Engineers

January 2016

Job ref:

J9278

Report author:

Thomas Richardson MSc ACIfA

GEOPHYSICAL SURVEY REPORT

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Job ref:

J9278

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**Detailed magnetic survey –
Gradiometry**

Project manager:

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Survey date:

**23rd-24th December 2015 &
12th January 2016**

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TABLE OF CONTENTS

LIST OF FIGURES.....	2
1 SUMMARY OF RESULTS	3
2 INTRODUCTION	3
2.1 Background synopsis.....	3
2.2 Site location	3
2.3 Description of site	3
2.4 Geology and soils	3
2.5 Site history and archaeological potential	4
2.6 Survey objectives	4
2.7 Survey methods	4
2.8 Processing, presentation and interpretation of results.....	4
2.8.1 Processing	4
2.8.2 Presentation of results and interpretation.....	5
3 RESULTS.....	5
3.1 Probable Archaeology.....	5
3.2 Possible Archaeology	5
3.3 Medieval/Post-Medieval Agriculture.....	6
3.4 Other Anomalies	6
4 DATA APPRAISAL & CONFIDENCE ASSESSMENT	7
5 CONCLUSION	7
6 REFERENCES	8
APPENDIX A – METHODOLOGY & SURVEY EQUIPMENT	9
APPENDIX B – BASIC PRINCIPLES OF MAGNETIC SURVEY	10
APPENDIX C – GLOSSARY OF MAGNETIC ANOMALIES.....	11

LIST OF FIGURES

Figure 01	1:25 000	Location plan of survey area
Figure 02	1:3000	Location of survey grids and referencing
Figure 03	1:2500	Colour plot of gradiometer data showing extreme values – overview
Figure 04	1:1250	Colour plot of gradiometer data showing extreme values – south west
Figure 05	1:1250	Colour plot of gradiometer data showing extreme values – north east
Figure 06	1:2500	Plot of minimally processed gradiometer data – overview
Figure 07	1:1250	Plot of minimally processed gradiometer data – south west
Figure 08	1:1250	Plot of minimally processed gradiometer data – north east
Figure 09	1:2500	Abstraction and interpretation of gradiometer anomalies – overview
Figure 10	1:1250	Abstraction and interpretation of gradiometer anomalies – south west
Figure 11	1:1250	Abstraction and interpretation of gradiometer anomalies – north east

1 SUMMARY OF RESULTS

A detailed gradiometry survey was conducted over approximately 4.6 hectares of grassland. The survey has identified areas of ridge and furrow as the only definite archaeology on the site. A possible ditch at the northern end of the survey route may be associated to nearby Bronze Age round barrows, however this anomaly could equally relate to a palaeochannel or drainage ditch. The detection of post-medieval ridge and furrow, as well as medieval ridge and furrow in the surrounding area recorded in the HER, suggests that the site has been used for agricultural purposes since the medieval period. The remaining anomalies are natural or modern in origin relating to a footpath, made ground, scattered magnetic debris, ferrous objects, and fencing.

2 INTRODUCTION

2.1 *Background synopsis*

Stratascan were commissioned to undertake a geophysical survey of an area outlined for development as part of a road improvement scheme. This survey forms part of an archaeological investigation being undertaken by Arup Consulting Engineers.

2.2 *Site location*

The site is located to the north of Machynlleth, Powys. It is a linear corridor approximately 950m along the proposed route of the A487 improvement scheme crossing the River Dovey where a new bridge is planned. The site follows the route of the A487, centred on OS ref. SH 748 019.

2.3 *Description of site*

The site is approximately 5.9 hectares, split over five areas. Standing water, woodland, and steep slopes reduced the surveyable area to approximately 4.6 hectares of grassland. The site lies in a valley bottom, and is generally flat across the south-west, with steep south facing slopes in the north-east.

2.4 *Geology and soils*

The underlying geology is Borth Mudstones Formation – mudstone (British Geological Survey website). The drift geology is Alluvium – clay, silt, sand, and gravel across the majority of the site, with small areas of Head – clay, silt, sand, and gravel and Alluvial Fan Deposits 1 – gravel present in the north-east (British Geological Survey website).

The overlying soils are known as Conway, which are typical alluvial gley soils. These consist of deep, stoneless, fine silty and clayey soils (Soil Survey of England and Wales, Sheet 2 Wales England).

2.5 **Site history and archaeological potential**

A search of the Clwyd-Powys Archaeological Trust and Gwynedd Archaeological Trust Historic Environment Records (HER) shows potential for Bronze Age activity and limited potential for Roman activity in the area. Two Bronze Age round barrows (Gwynedd PRN: 15932 and 15933) are recorded approximately 75m to the east of the northern end of the survey. A section of supposed Roman road from Pennal to Ffestiniog (Clwyd-Powys PRN: 69943) is located approximately 250m to the north-east of the survey area. An area of ridge and furrow cultivation (Clwyd-Powys PRN: 36897) is also recorded approximately 150m south of the site (Clwyd-Powys Archaeological Trust 2016 and Gwynedd Archaeological Trust 2016).

2.6 **Survey objectives**

The objective of the survey was to locate any features of possible archaeological origin in order that they may be assessed prior to development.

2.7 **Survey methods**

This report and all fieldwork have been conducted in accordance with both the English Heritage guidelines outlined in the document: *Geophysical Survey in Archaeological Field Evaluation, 2008* and with the Chartered Institute for Archaeologists document *Standard and Guidance for Archaeological Geophysical Survey*.

Given the potential for Roman activity and agricultural features, detailed magnetic survey (gradiometry) was used as an efficient and effective method of locating archaeological anomalies. More information regarding this technique is included in Appendix A.

2.8 **Processing, presentation and interpretation of results**

2.8.1 **Processing**

Processing is performed using specialist software. This can emphasise various aspects contained within the data but which are often not easily seen in the raw data. Basic processing of the magnetic data involves 'flattening' the background levels with respect to adjacent traverses and adjacent grids. Once the basic processing has flattened the background it is then possible to carry out further processing which may include low pass filtering to reduce 'noise' in the data and hence emphasise the archaeological or man-made anomalies.

The following schedule shows the basic processing carried out on all minimally processed gradiometer data used in this report:

1. *Destripe* (Removes striping effects caused by zero-point discrepancies between different sensors and walking directions)
2. *Destagger* (Removes zigzag effects caused by inconsistent walking speeds on sloping, uneven or overgrown terrain)

2.8.2 Presentation of results and interpretation

The presentation of the data for each site involves a print-out of the minimally processed data both as a greyscale plot and a colour plot showing extreme magnetic values. Magnetic anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawing for the site.

3 RESULTS

The detailed magnetic gradiometer survey conducted at Machynlleth has identified a single anomaly that has been characterised as being of a *possible* archaeological origin.

The difference between *probable* and *possible* archaeological origin is a confidence rating. Features identified within the dataset that form recognisable archaeological patterns or seem to be related to a deliberate historical act have been interpreted as being of a probable archaeological origin.

Features of possible archaeological origin tend to be more amorphous anomalies which may have similar magnetic attributes in terms of strength or polarity but are difficult to classify as being archaeological or natural.

The following list of numbered anomalies refers to numerical labels on the interpretation plots.

3.1 Probable Archaeology

No probable archaeology has been identified within the survey area.

3.2 Possible Archaeology

- 1 A sinuous positive linear anomaly in the north-east of the site. This is indicative of a former cut feature, and may relate to a former ditch. Given the proximity it is possible that this is associated with two Bronze Age barrows recorded in the HER (Gwynedd Archaeological Trust 2016). However, it could also relate to a palaeochannel or drainage ditch.

3.3 *Medieval/Post-Medieval Agriculture*

- 2 A positive linear anomaly in the south-west of the site. This is likely related to a former field boundary not present on available mapping. The boundary appears to enclose an area of ridge and furrow ploughing (Anomaly 2).
- 3 Two areas of widely spaced parallel linear anomalies in the south-west and north-east of the site. These are related to ridge and furrow cultivation. The relatively straight nature of the ploughing suggests they are likely post-medieval in date.
- 4 An area of closely spaced parallel linear anomalies in the south-west of the site. This is related to modern agricultural activity, such as ploughing.

3.4 *Other Anomalies*

- 5 A positive linear anomaly in the centre of the site. This is related to a modern footpath.
- 6 Small areas of magnetic variation in the north-east and centre of the site. These anomalies are likely geological or pedological in origin.
- 7 An area of strongly magnetic dipolar responses in the north-east of the site. This is indicative of an area of made ground, possibly related to construction of the A487.
- 8 Areas of scattered magnetic debris in the north-east of the site. These are likely to be modern in origin, possibly related to construction of the A487.
- 9 Areas of magnetic disturbance are the result of substantial nearby ferrous metal objects such as fences and underground services. These effects can mask weaker archaeological anomalies, but on this site have not affected a significant proportion of the area.
- 10 A number of magnetic 'spikes' (strong focussed values with associated antipolar response) indicate ferrous metal objects. These are likely to be modern rubbish.

4 DATA APPRAISAL & CONFIDENCE ASSESSMENT

Mudstone geologies, such as those at Machynlleth, can give variable responses to magnetic survey. Whilst overlying alluvial and head deposits do have potential to mask weaker archaeological anomalies. Areas of ridge and furrow, as well as a former field boundary and possible ditch, are seen in the north and south of the site, suggesting that the survey has been effective. However these responses are generally weak, meaning the possibility that archaeological anomalies are being masked by the alluvial and head deposits cannot be completely discounted. Responses in the north show a greater magnetic contrast. This enhancement corresponds with the change in superficial geology suggesting that the Head and Alluvial fan deposits to the north of the river are more conducive to producing good results than the alluvial deposits to the south. It remains possible that weaker archaeological anomalies may be masked by the superficial deposits south of the River Dovey.

5 CONCLUSION

The survey at Machynlleth has identified areas of ridge and furrow as the only definite archaeology on the site. A possible ditch at the northern end of the survey route may be associated to nearby Bronze Age round barrows, however this anomaly could equally relate to a palaeochannel or drainage ditch. There is no evidence Roman activity, which the HER shows limited potential for in the area. The detection of post-medieval ridge and furrow, as well as medieval ridge and furrow in surrounding area recorded in the HER, suggests that the site has been used for agricultural purposes since the medieval period. The remaining anomalies are modern or natural in origin. The modern anomalies relate to a footpath, made ground, scattered magnetic debris, ferrous objects, and fencing.

6 REFERENCES

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APPENDIX A – METHODOLOGY & SURVEY EQUIPMENT

Grid locations

The location of the survey grids has been plotted together with the referencing information. Grids were set out using a Leica 705auto Total Station and referenced to suitable topographic features around the perimeter of the site or a Leica Smart Rover RTK GPS.

An RTK GPS (Real-time Kinematic Global Positioning System) can locate a point on the ground to a far greater accuracy than a standard GPS unit. A standard GPS suffers from errors created by satellite orbit errors, clock errors and atmospheric interference, resulting in an accuracy of 5m-10m. An RTK system uses a single base station receiver and a number of mobile units. The base station re-broadcasts the phase of the carrier it measured, and the mobile units compare their own phase measurements with those they received from the base station. A SmartNet RTK GPS uses Ordnance Survey's network of over 100 fixed base stations to give an accuracy of around 0.01m.

Survey equipment and gradiometer configuration

Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.2 nanoTeslas (nT) in an overall field strength of 48,000nT, can be accurately detected using an appropriate instrument.

The mapping of the anomaly in a systematic manner will allow an estimate of the type of material present beneath the surface. Strong magnetic anomalies will be generated by buried iron-based objects or by kilns or hearths. More subtle anomalies such as pits and ditches can be seen if they contain more humic material which is normally rich in magnetic iron oxides when compared with the subsoil.

To illustrate this point, the cutting and subsequent silting or backfilling of a ditch may result in a larger volume of weakly magnetic material being accumulated in the trench compared to the undisturbed subsoil. A weak magnetic anomaly should therefore appear in plan along the line of the ditch.

The magnetic survey was carried out using a dual sensor Grad601-2 Magnetic Gradiometer manufactured by Bartington Instruments Ltd. The instrument consists of two fluxgates very accurately aligned to nullify the effects of the Earth's magnetic field. Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background. The Grad601-2 consists of two high stability fluxgate gradiometers suspended on a single frame. Each gradiometer has a 1m separation between the sensing elements so enhancing the response to weak anomalies.

Sampling interval

Readings were taken at 0.25m centres along traverses 1m apart. This equates to 3600 sampling points in a full 30m x 30m grid.

Depth of scan and resolution

The Grad 601-2 has a typical depth of penetration of 0.5m to 1.0m, though strongly magnetic objects may be visible at greater depths. The collection of data at 0.25m centres provides an optimum methodology for the task balancing cost and time with resolution.

Data capture

The readings are logged consecutively into the data logger which in turn is daily down-loaded into a portable computer whilst on site. At the end of each site survey, data is transferred to the office for processing and presentation.

APPENDIX B – BASIC PRINCIPLES OF MAGNETIC SURVEY

Detailed magnetic survey can be used to effectively define areas of past human activity by mapping spatial variation and contrast in the magnetic properties of soil, subsoil and bedrock.

Weakly magnetic iron minerals are always present within the soil and areas of enhancement relate to increases in *magnetic susceptibility* and permanently magnetised *thermoremanent* material.

Magnetic susceptibility relates to the induced magnetism of a material when in the presence of a magnetic field. This magnetism can be considered as effectively permanent as it exists within the Earth's magnetic field. Magnetic susceptibility can become enhanced due to burning and complex biological or fermentation processes.

Thermoremanence is a permanent magnetism acquired by iron minerals that, after heating to a specific temperature known as the Curie Point, are effectively demagnetised followed by re-magnetisation by the Earth's magnetic field on cooling. Thermoremanent archaeological features can include hearths and kilns and material such as brick and tile may be magnetised through the same process.

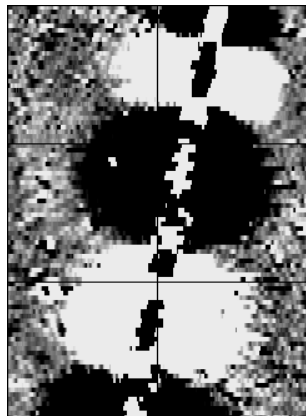
Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement allowing assessment and characterisation of subsurface features. Material such as subsoil and non-magnetic bedrock used to create former earthworks and walls may be mapped as areas of lower enhancement compared to surrounding soils.

Magnetic survey is carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field whilst the lower sensor measures the same field but is also more affected by any localised buried field. The difference between the two sensors will relate to the strength of a magnetic field created by a buried feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity, disturbance from modern services etc.

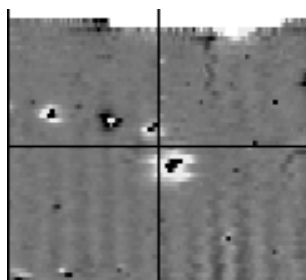
APPENDIX C – GLOSSARY OF MAGNETIC ANOMALIES

Bipolar



A bipolar anomaly is one that is composed of both a positive response and a negative response. It can be made up of any number of positive responses and negative responses. For example a pipeline consisting of alternating positive and negative anomalies is said to be bipolar. See also dipolar which has only one area of each polarity. The interpretation of the anomaly will depend on the magnitude of the magnetic field strength. A weak response may be caused by a clay field drain while a strong response will probably be caused by a metallic service.

Dipolar

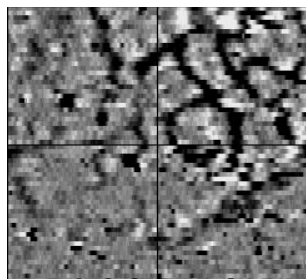


This consists of a single positive anomaly with an associated negative response. There should be no separation between the two polarities of response. These responses will be created by a single feature. The interpretation of the anomaly will depend on the magnitude of the magnetic measurements. A very strong anomaly is likely to be caused by a ferrous object.

Positive anomaly with associated negative response

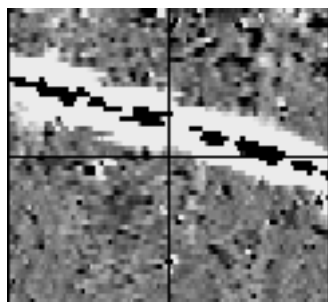
See bipolar and dipolar.

Positive linear



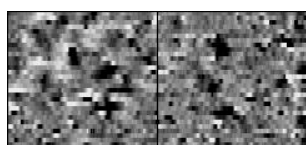
A linear response which is entirely positive in polarity. These are usually related to in-filled cut features where the fill material is magnetically enhanced compared to the surrounding matrix. They can be caused by ditches of an archaeological origin, but also former field boundaries, ploughing activity and some may even have a natural origin.

Positive linear anomaly with associated negative response



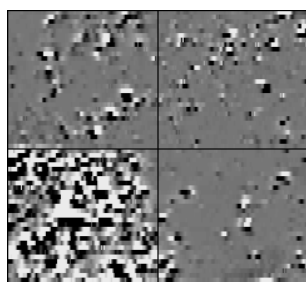
A positive linear anomaly which has a negative anomaly located adjacently. This will be caused by a single feature. In the example shown this is likely to be a single length of wire/cable probably relating to a modern service. Magnetically weaker responses may relate to earthwork style features and field boundaries.

Positive point/area



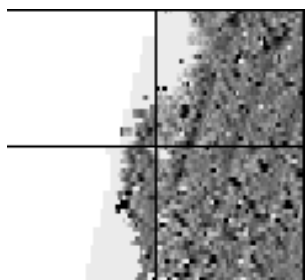
These are generally spatially small responses, perhaps covering just 3 or 4 reading nodes. They are entirely positive in polarity. Similar to positive linear anomalies they are generally caused by in-filled cut features. These include pits of an archaeological origin, possible tree bowls or other naturally occurring depressions in the ground.

Magnetic debris



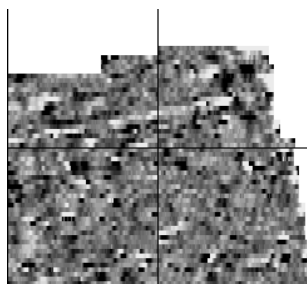
Magnetic debris consists of numerous dipolar responses spread over an area. If the amplitude of response is low ($\pm 3\text{nT}$) then the origin is likely to represent general ground disturbance with no clear cause, it may be related to something as simple as an area of dug or mixed earth. A stronger anomaly ($\pm 250\text{nT}$) is more indicative of a spread of ferrous debris. Moderately strong anomalies may be the result of a spread of thermoremanent material such as bricks or ash.

Magnetic disturbance



Magnetic disturbance is high amplitude and can be composed of either a bipolar anomaly, or a single polarity response. It is essentially associated with magnetic interference from modern ferrous structures such as fencing, vehicles or buildings, and as a result is commonly found around the perimeter of a site near to boundary fences.

Negative linear

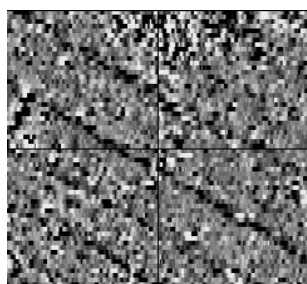


A linear response which is entirely negative in polarity. These are generally caused by earthen banks where material with a lower magnetic magnitude relative to the background top soil is built up. See also ploughing activity.

Negative point/area

Opposite to positive point anomalies these responses may be caused by raised areas or earthen banks. These could be of an archaeological origin or may have a natural origin.

Ploughing activity



Ploughing activity can often be visualised by a series of parallel linear anomalies. These can be of either positive polarity or negative polarity depending on site specifics. It can be difficult to distinguish between ancient ploughing and more modern ploughing. Clues such as the separation of each linear, straightness, strength of response and cross cutting relationships can be used to aid this, although none of these can be guaranteed to differentiate between different phases of activity.

Polarity

Term used to describe the measurement of the magnetic response. An anomaly can have a positive polarity (values above 0nT) and/or a negative polarity (values below 0nT).

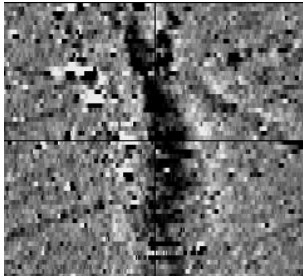
Strength of response

The amplitude of a magnetic response is an important factor in assigning an interpretation to a particular anomaly. For example a positive anomaly covering a 10m² area may have values up to around 3000nT, in which case it is likely to be caused by modern magnetic interference. However, the same size and shaped anomaly but with values up to only 4nT may have a natural origin. Colour plots are used to show the amplitude of response.

Thermoremanent response

A feature which has been subject to heat may result in it acquiring a magnetic field. This can be anything up to approximately ± 100 nT in value. These features include clay fired drains, brick, bonfires, kilns, hearths and even pottery. If the heat application has occurred in situ (e.g. a kiln) then the response is likely to be bipolar compared to if the heated objects have been disturbed and moved relative to each other, in which case they are more likely to take an irregular form and may display a debris style response (e.g. ash).

Weak background variations



Weakly magnetic wide scale variations within the data can sometimes be seen within sites. These usually have no specific structure but can often appear curvy and sinuous in form. They are likely to be the result of natural features, such as soil creep, dried up (or seasonal) streams. They can also be caused by changes in the underlying geology or soil type which may contain unpredictable distributions of magnetic minerals, and are usually apparent in several locations across a site.

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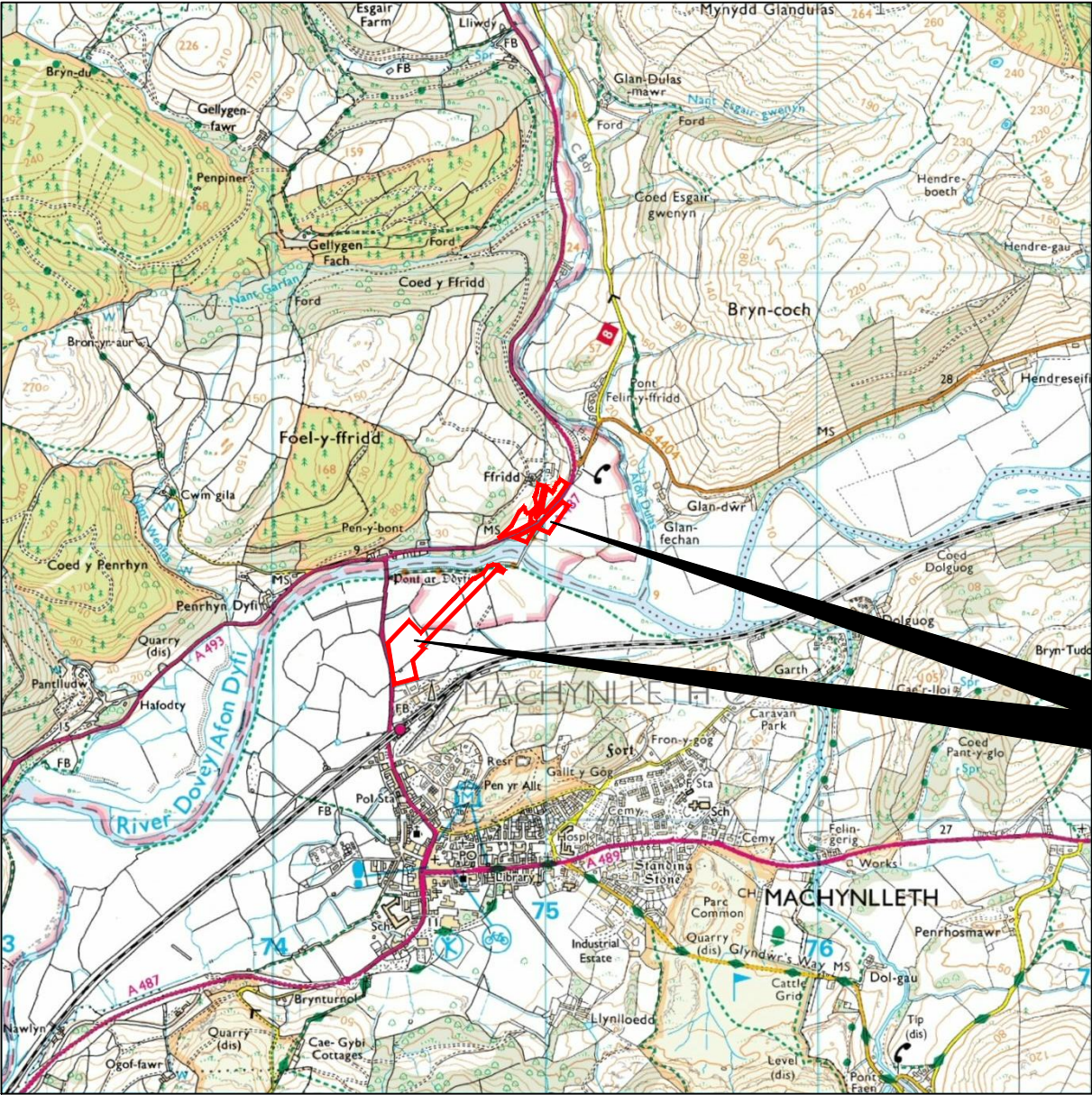
04

03

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Survey Area

73

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77

Amendments

Issue No.	Date	Description
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Site centred on NGR SH 748 019

Client
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Project Title Job No. J9278
A487 MACHYNLLETH, POWYS

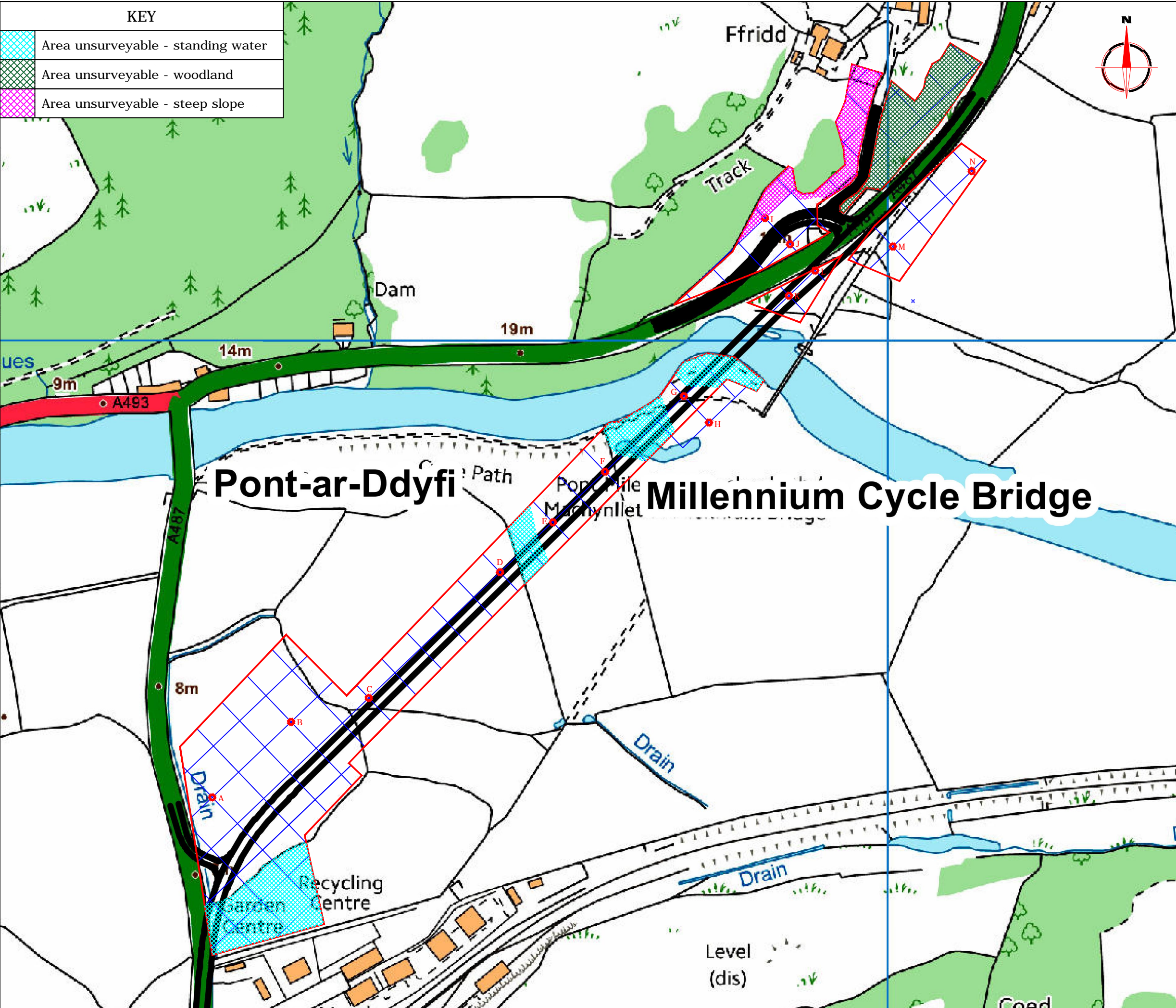
Subject
LOCATION PLAN OF SURVEY AREA




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VINEYARD HOUSE T: 01684 592266
UPTON UPON SEVERN E: info@stratascan.co.uk
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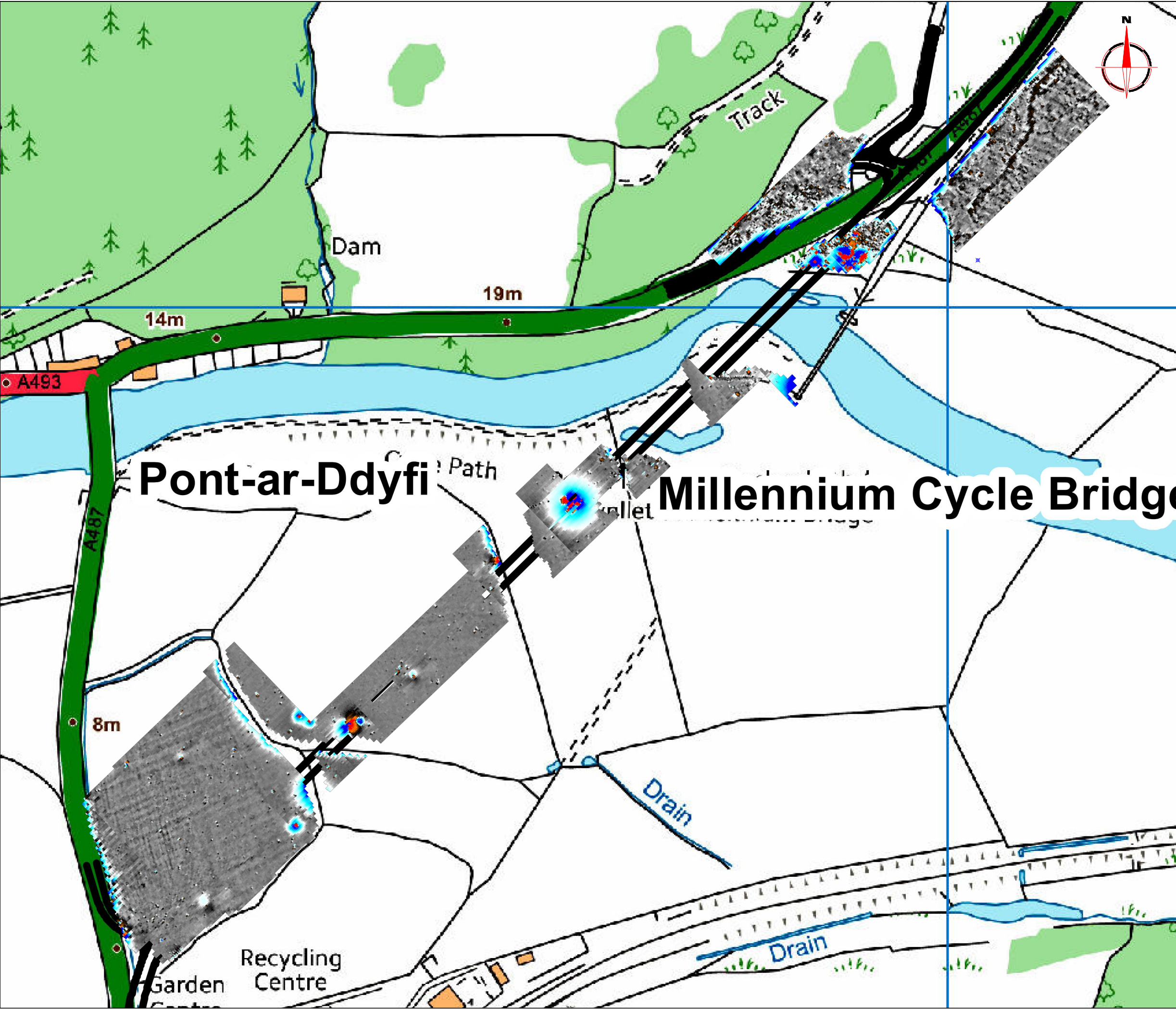


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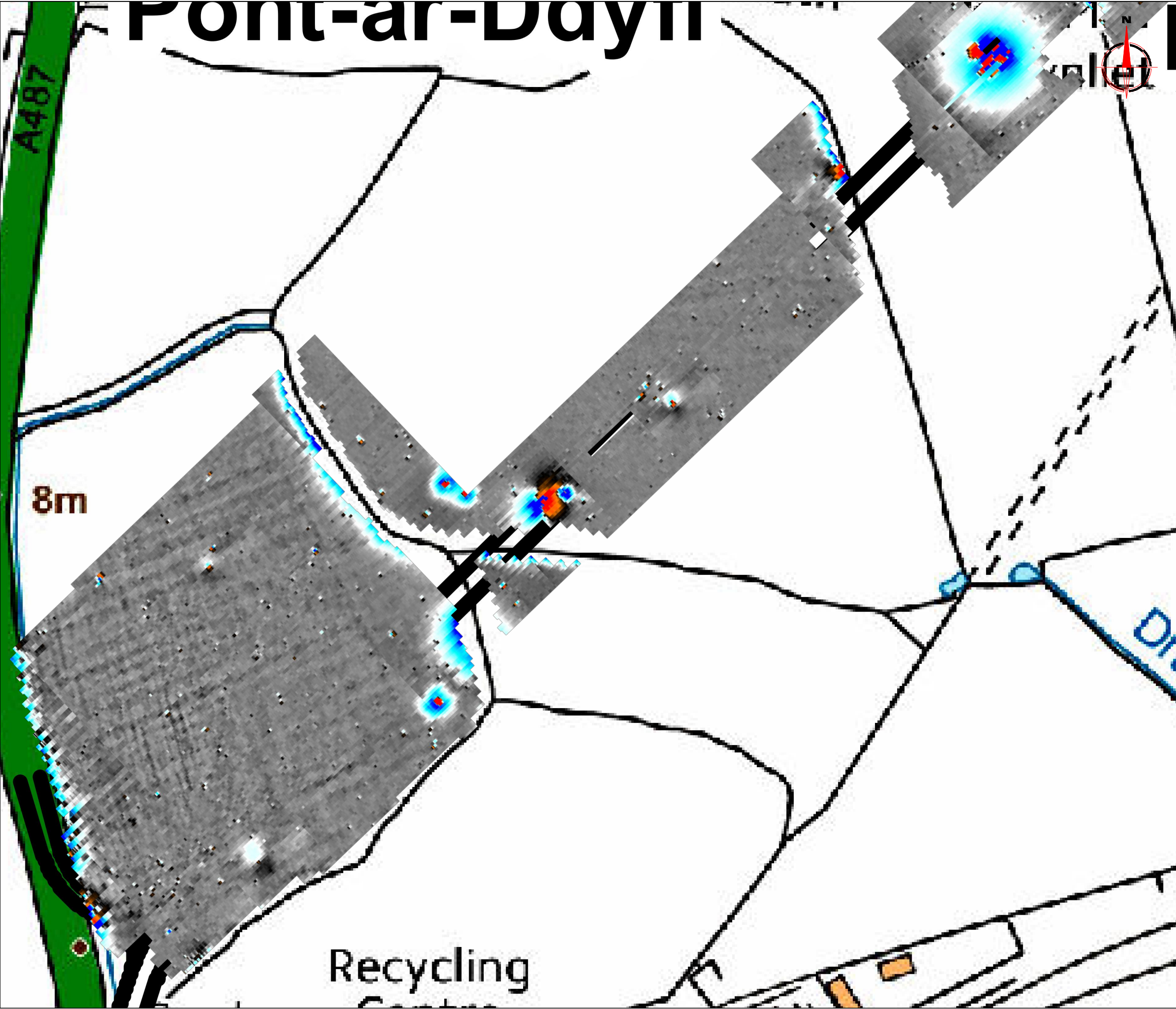
Plot A3	Checked by DGE	Issue No. 01
Survey date DEC 15	Drawn by TR	Figure No. 01



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Client		
ARUP CONSULTING ENGINEERS		
Project Title		Job No. J9278
A487 MACHYNLLETH, POWYS		
Subject		
LOCATION OF SURVEY GRIDS AND REFERENCING		
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DEC 15	TR	02



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Issue No.	Date	Description
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Plotting parameters		
Maximum + 100nT (red)		+ 100nT
Minimum - 100nT (blue)		+ 25nT
		+ 3nT
		- 3nT
		- 25nT
		- 100nT
Client		
ARUP CONSULTING ENGINEERS		
Project Title		Job No. J9278
A487 MACHYNLLETH, POWYS		
Subject		
COLOUR PLOT OF GRADIOMETER DATA SHOWING EXTREME VALUES - OVERVIEW		
STRATASCAN™		
GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING		
VINEYARD HOUSE		T: 01684 592266
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Survey date DEC 15	Drawn by TR	Figure No. 03



Amendments

Issue No.	Date	Description
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Plotting parameters

Maximum + 100nT (red)
Minimum - 100nT (blue)

+ 100nT

+ 25nT

+ 3nT

- 3nT

- 25nT

- 100nT

Client

ARUP CONSULTING ENGINEERS

Project Title

Job No.

J9278

A487 MACHYNLLETH, POWYS

Subject

COLOUR PLOT OF GRADIOMETER DATA SHOWING EXTREME VALUES - SOUTH WEST

STRATASCAN™

GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING

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EUROPEAN GPR ASSOCIATION

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SURVEY SERVICES

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ims

ISO 9001 certified

UKAS

MANUFACTURING

078

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UKAS

ENVIRONMENTAL MANAGEMENT

078

Scale

1: 1250

0m 10 20 30 40 50m

Plot

A3

Checked by

DGE

Issue No.

01

Survey date

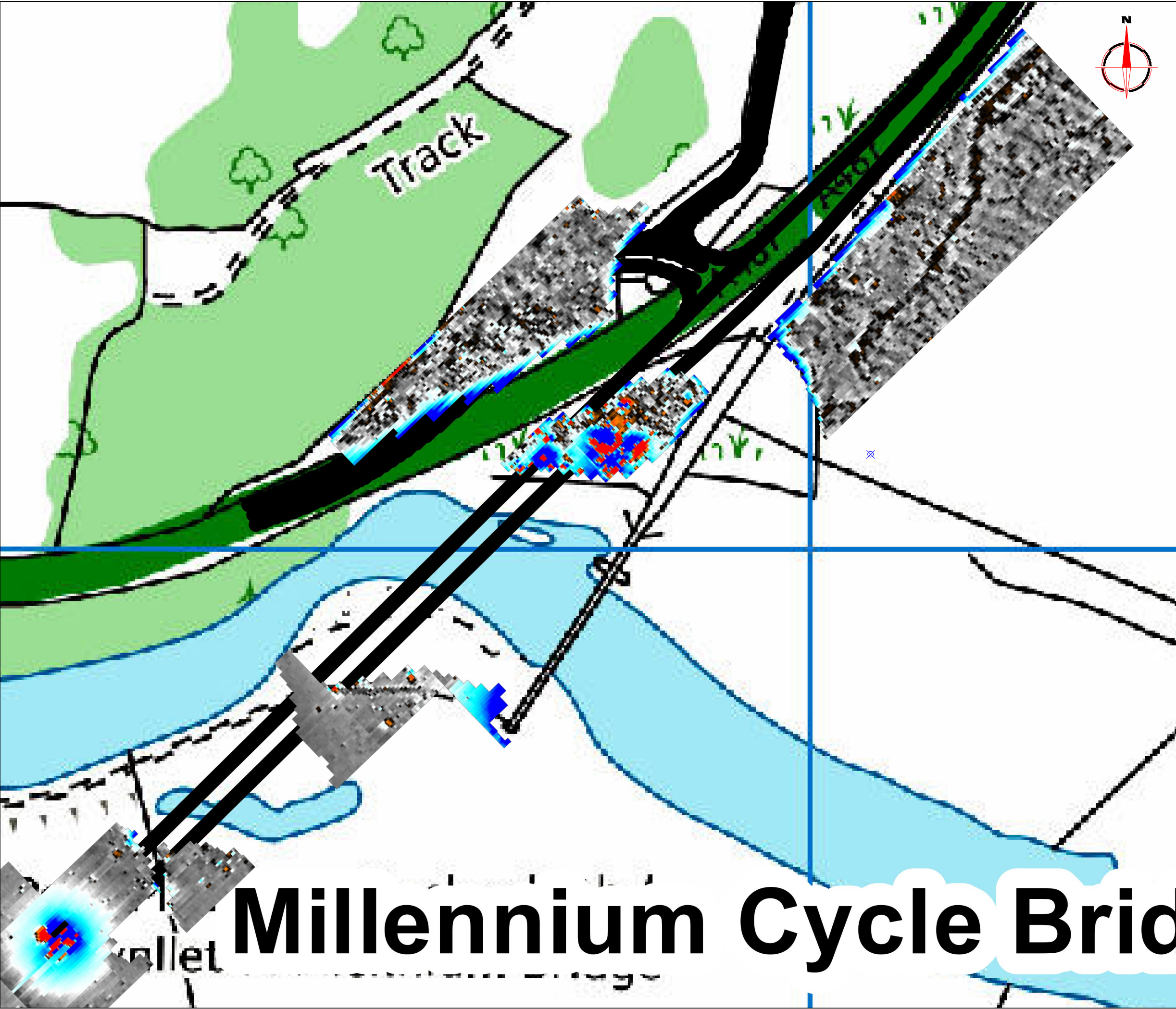
DEC 15

Drawn by

TR

Figure No.

04



Amendments		
Issue No.	Date	Description
-	-	-
-	-	-
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Plotting parameters

Maximum + 100nT (red)
Minimum - 100nT (blue)

+ 100nT
+ 25nT
+ 3nT
- 3nT
- 25nT
- 100nT

Client
ARUP CONSULTING ENGINEERS

Project Title
A487 MACHYNLLETH, POWYS

Job No.
J9278

Subject
COLOUR PLOT OF GRADIOMETER DATA SHOWING EXTREME VALUES - NORTH EAST

STRATASCAN™
GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING

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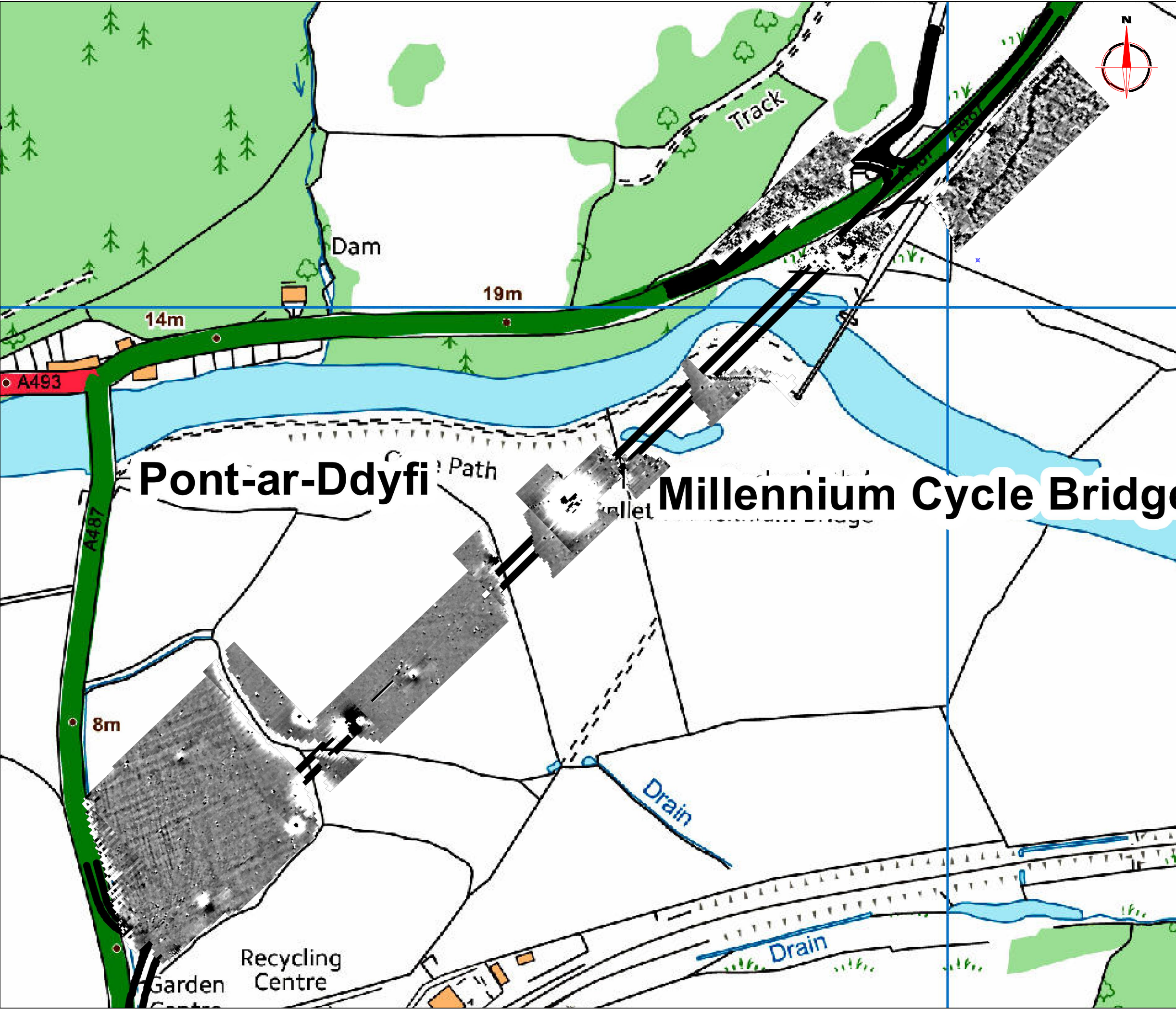
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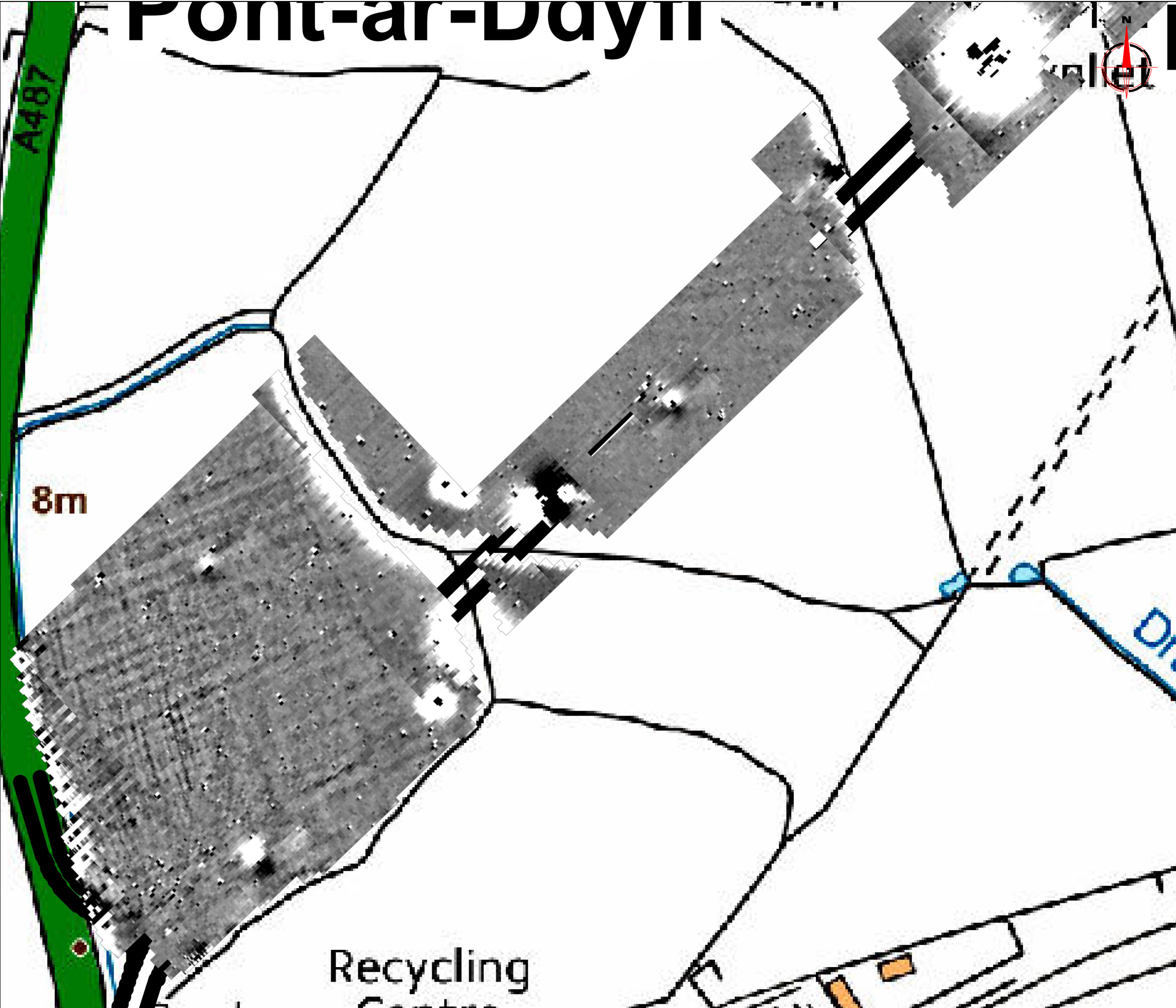
Scale
1: 1250

0m 10 20 30 40 50m

Plot A3	Checked by DGE	Issue No. 01
Survey date DEC 15	Drawn by TR	Figure No. 05



Amendments		
Issue No.	Date	Description
-	-	-
-	-	-
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Plotting parameters		
Maximum +2nT (black)		
Minimum -2nT (white)		
<div>Zero Mean</div> <div>-2nT +2nT</div>		
<div>+2nT</div> <div>-2nT</div>		
Client		
ARUP CONSULTING ENGINEERS		
Project Title		
Job No. J9278		
A487 MACHYNLLETH, POWYS		
Subject		
PLOT OF MINIMALLY PROCESSED GRADIOMETER DATA - OVERVIEW		
STRATASCAN™		
GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING		
VINEYARD HOUSE T: 01684 592266		
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<div>EUROPEAN GPR ASSOCIATION</div> <div>SURVEY SERVICES</div> <div>SUMO GROUP MEMBER</div> <div>IMS ISO 9001 certified</div> <div>UKAS QUALITY 078</div> <div>IMS ISO 14001 certified</div> <div>UKAS ENVIRONMENTAL 078</div>		
Scale 1:2500		
0m 50 100m		
Plot	Checked by	Issue No.
A3	DGE	01
Survey date	Drawn by	Figure No.
DEC 15	TR	06



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

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Plotting parameters

Maximum +2nT (black)
Minimum -2nT (white)

Zero
Mean

-2nT +2nT

+2nT

-2nT

Client

ARUP CONSULTING ENGINEERS

Project Title

Job No.

J9278

A487 MACHYNLLETH, POWYS

Subject

PLOT OF MINIMALLY PROCESSED
GRADIOMETER DATA - SOUTH WEST

STRATASCAN™

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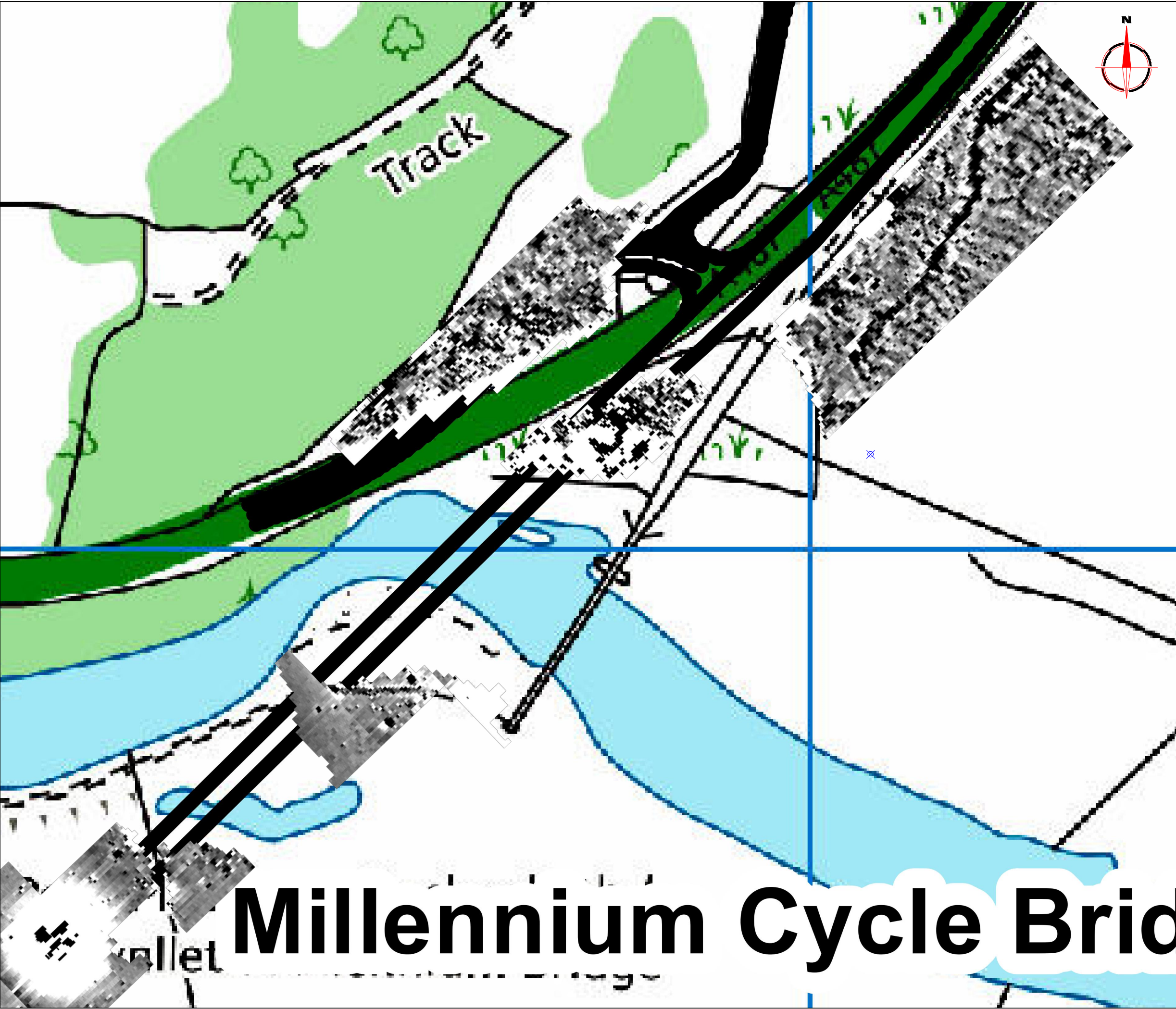
ISO 14001 certified

Scale

1:1250

0m 10 20 30 40 50m

Plot	A3	Checked by	DGE	Issue No.	01
Survey date	DEC 15	Drawn by	TR	Figure No.	07



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

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Plotting parameters

Maximum +2nT (black)
Minimum -2nT (white)

Zero Mean

+2nT

-2nT

Client

ARUP CONSULTING ENGINEERS

Project Title

Job No.

J9278

A487 MACHYNLLETH, POWYS

Subject

PLOT OF MINIMALLY PROCESSED
GRADIOMETER DATA - NORTH EAST

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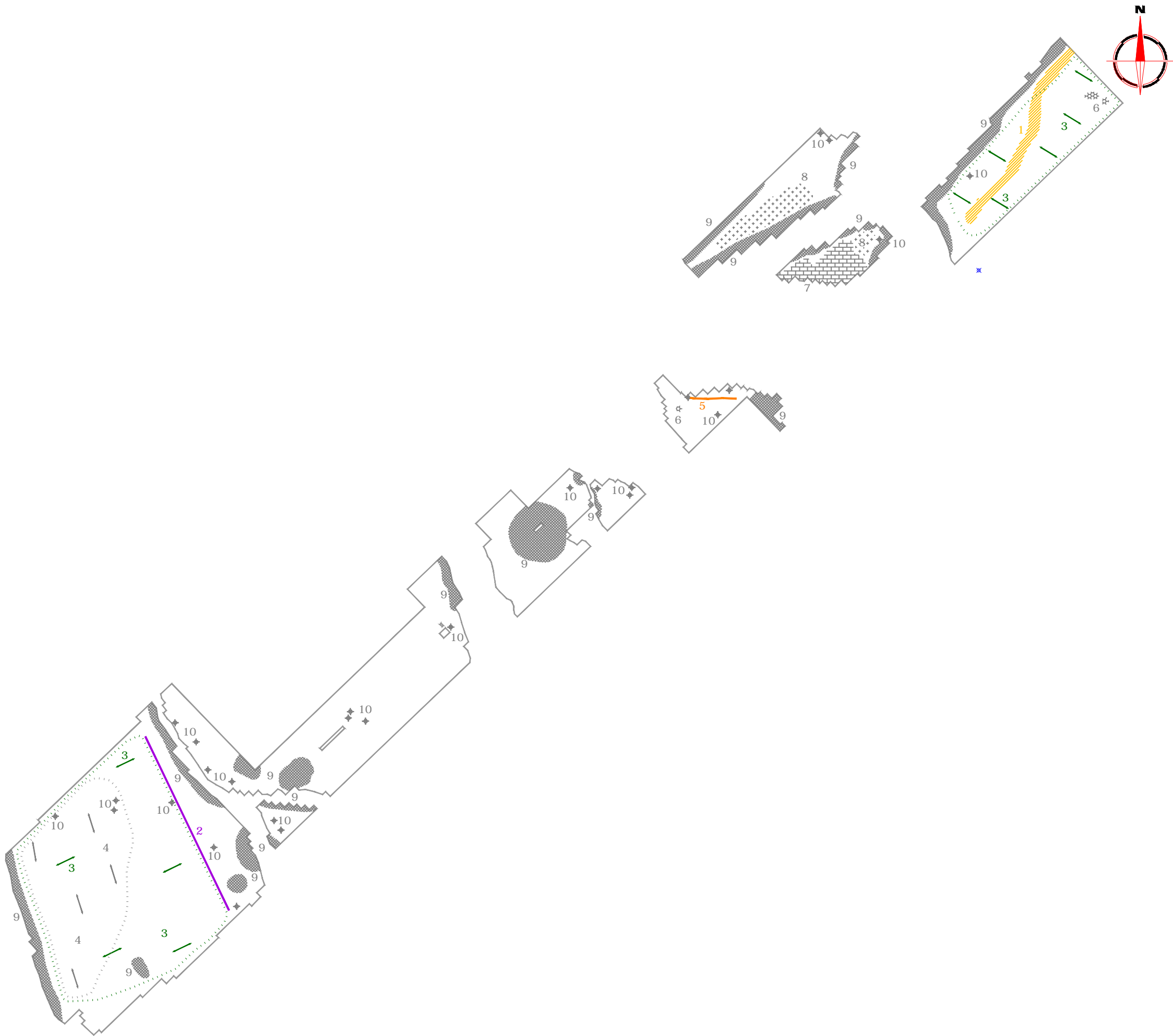
Scale

1: 1250

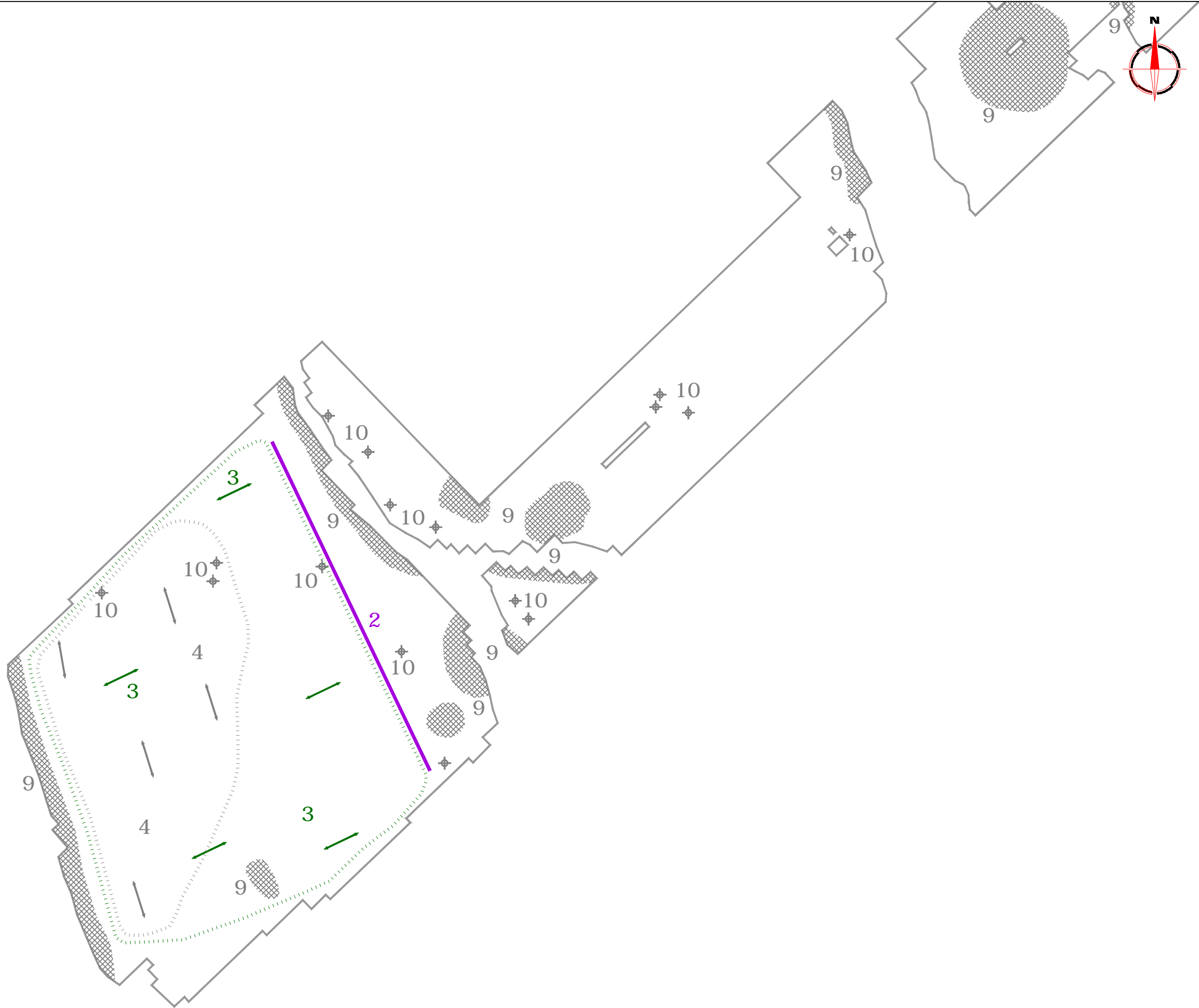
0m 10 20 30 40 50m

Plot	A3	Checked by	DGE	Issue No.	01
Survey date	DEC 15	Drawn by	TR	Figure No.	08

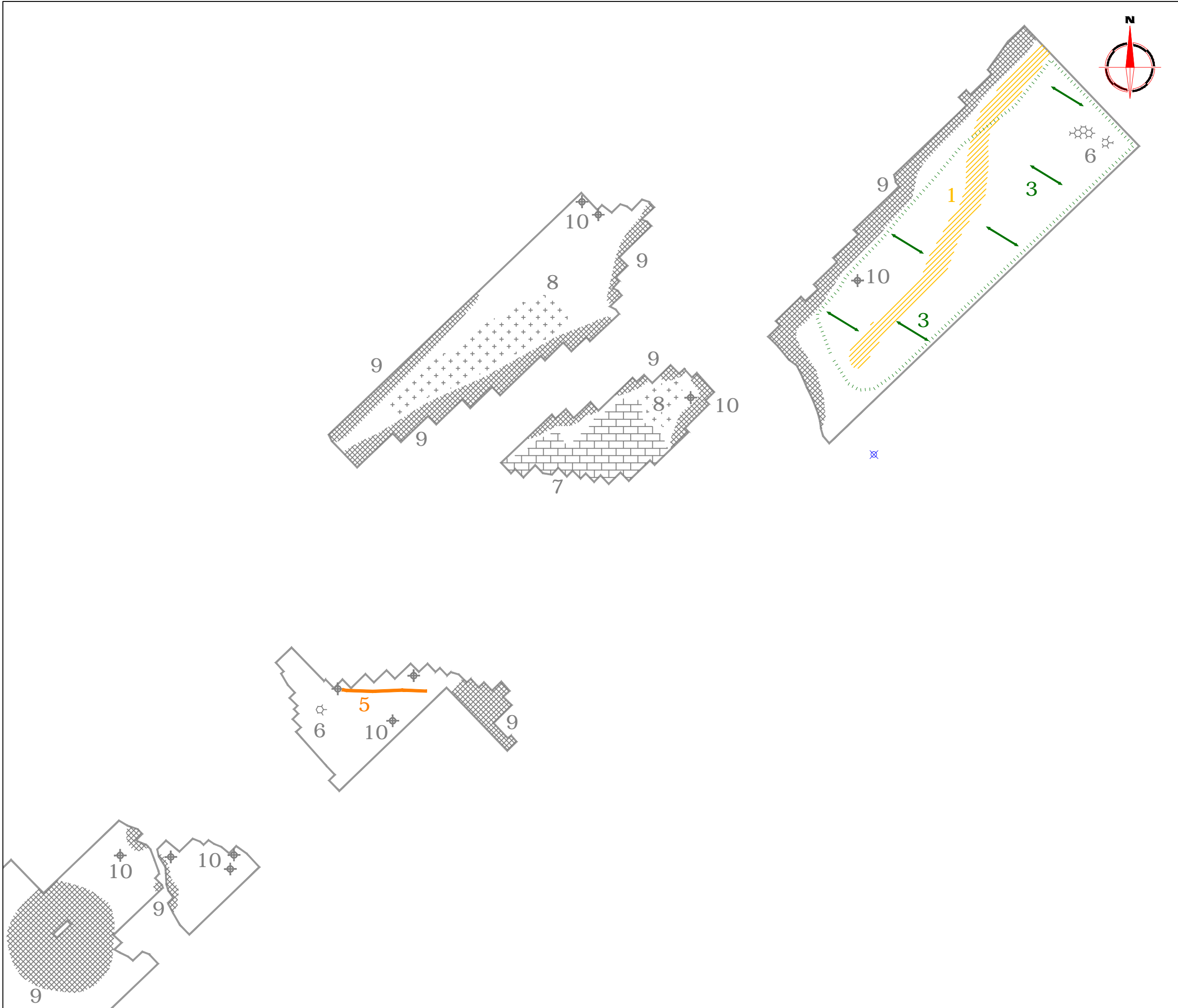
Millennium Cycle Bridge



Amendments		
Issue No.	Date	Description
-	-	-
-	-	-
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PROBABLE ARCHAEOLOGY		
	Positive anomaly / weak positive anomaly - probable cut feature of archaeological origin	
	Negative anomaly / weak negative anomaly - probable bank or earthwork of archaeological origin	
POSSIBLE ARCHAEOLOGY		
	Positive anomaly / weak positive anomaly - possible cut feature of archaeological origin	
	Negative anomaly / weak negative anomaly - possible bank or earthwork of archaeological origin	
MEDIEVAL/POST-MEDIEVAL AGRICULTURE		
	Widely spaced parallel linear anomalies - probably related to ridge-and-furrow	
	Closely spaced parallel linear anomalies - probably related to agricultural activity such as ploughing	
	Linear anomaly - probably related to a former field boundary not present on available mapping	
	Linear anomaly - related to a former field boundary present on available mapping	
OTHER ANOMALIES		
	Linear anomaly - probably related to pipe, cable or other modern service	
	Linear anomaly - modern footpath	
	Magnetic disturbance associated with nearby metal object such as service or field boundary	
	Strong magnetic debris - possible disturbed or made ground	
	Weak scattered magnetic debris	
	Area of amorphous magnetic variation - probable natural (e.g. geological or pedological) origin	
	Magnetic spike - probably ferrous object	
Client		
ARUP CONSULTING ENGINEERS		
Project Title		Job No. J9278
A487 MACHYNLLETH, POWYS		
Subject		
ABSTRACTION AND INTERPRETATION OF GRADIOMETER ANOMALIES - OVERVIEW		
<div>STRATASCAN™</div> <div>GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING</div> <div>VINEYARD HOUSE UPTON UPON SEVERN WR8 0SA</div> <div>T: 01684 592266 E: info@stratascan.co.uk www.stratascan.co.uk</div> <div></div> <div>Scale 1: 2500</div> <div></div>		
Plot	Checked by	Issue No.
A3	DGE	01
Survey date	Drawn by	Figure No.
DEC 15	TR	09



Amendments		
Issue No.	Date	Description
-	-	-
-	-	-
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PROBABLE ARCHAEOLOGY		
	Positive anomaly / weak positive anomaly - probable cut feature of archaeological origin	
	Negative anomaly / weak negative anomaly - probable bank or earthwork of archaeological origin	
POSSIBLE ARCHAEOLOGY		
	Positive anomaly / weak positive anomaly - possible cut feature of archaeological origin	
	Negative anomaly / weak negative anomaly - possible bank or earthwork of archaeological origin	
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	Linear anomaly - probably related to pipe, cable or other modern service	
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	Magnetic disturbance associated with nearby metal object such as service or field boundary	
	Strong magnetic debris - possible disturbed or made ground	
	Weak scattered magnetic debris	
	Area of amorphous magnetic variation - probable natural (e.g. geological or pedological) origin	
	Magnetic spike - probable ferrous object	
Client		
ARUP CONSULTING ENGINEERS		
Project Title		Job No. J9278
A487 MACHYNLLETH, POWYS		
Subject		
ABSTRACTION AND INTERPRETATION OF GRADIOMETER ANOMALIES - SOUTH WEST		
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Scale		0m 10 20 30 40 50m
1: 1250		
Plot	Checked by	Issue No.
A3	DGE	01
Survey date	Drawn by	Figure No.
DEC 15	TR	10



Amendments		
Issue No.	Date	Description
-	-	-
-	-	-
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PROBABLE ARCHAEOLOGY		
	Positive anomaly / weak positive anomaly - probable cut feature of archaeological origin	
	Negative anomaly / weak negative anomaly - probable bank or earthwork of archaeological origin	
POSSIBLE ARCHAEOLOGY		
	Positive anomaly / weak positive anomaly - possible cut feature of archaeological origin	
	Negative anomaly / weak negative anomaly - possible bank or earthwork of archaeological origin	
MEDIEVAL/POST-MEDIEVAL AGRICULTURE		
	Widely spaced parallel linear anomalies - probably related to ridge-and-furrow	
	Closely spaced parallel linear anomalies - probably related to agricultural activity such as ploughing	
	Linear anomaly - probably related to a former field boundary not present on available mapping	
	Linear anomaly - related to a former field boundary present on available mapping	
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	Linear anomaly - modern footpath	
	Magnetic disturbance associated with nearby metal object such as service or field boundary	
	Strong magnetic debris - possible disturbed or made ground	
	Weak scattered magnetic debris	
	Area of amorphous magnetic variation - probable natural (e.g. geological or pedological) origin	
	Magnetic spike - probable ferrous object	
Client		
ARUP CONSULTING ENGINEERS		
Project Title		Job No. J9278
A487 MACHYNLLETH, POWYS		
Subject		
ABSTRACTION AND INTERPRETATION OF GRADIOMETER ANOMALIES - NORTH EAST		
<div>STRATASCAN™</div> <div>GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING</div> <div>VINEYARD HOUSE T: 01684 592266</div> <div>UPTON UPON SEVERN E: info@stratascan.co.uk</div> <div>WR8 0SA www.stratascan.co.uk</div> <div></div> <div></div> <div>SUMO GROUP MEMBER</div> <div></div> <div></div> <div></div> <div></div>		
Scale		
1: 1250		
Plot	Checked by	Issue No.
A3	DGE	01
Survey date	Drawn by	Figure No.
DEC 15	TR	11

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