Appendix 15.2

Raitts Cave, Balavil Obelisk and Burial Ground and Chapelpark Geophysical Survey Report

A9 Dualling – Crubenmore to Kincraig, Raitts Cave, Balavil Obelisk and Burial Ground and Chapelpark

Geophysical Survey Report

Client	**CH2M FAIRHURST JV**
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Rev Number	Description	Undertaken	Approved	Date
1.0	DRAFT	GR	DD	10/11/2015
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1. NON TECHNICAL SUMMARY

1.1.1 AB Heritage Limited (herein AB Heritage) undertook a programme of geophysical survey from Monday 9th November 2015 to Monday 23rd November 2015 as part of the proposed dualling of the A9.

1.1.2 The survey was carried out across three sites, which consisted of: Raitts Cave, Balavil Obelisk and Burial Ground, and Chapelpark (see Figure 1).

Souterrain Raitts Cave

1.1.3 The detailed magnetic survey and resistivity concluded that there is potential for surviving archaeological features in the immediate vicinity, surrounding the souterrain. Also the results have shown the landscape surrounding the souterrain is likely to have a direct relationship with it.

Balavil Obelisk and Burial Ground

1.1.4 Survey at Balavil obelisk and burial ground has revealed possible modern disturbance within the site, though much of the area appears to have been flattened and appears as made ground within the survey area.

Chapelpark

1.1.5 A magnetometer survey was undertaken below the marshland at the north of Chapelpark, it revealed no significant archaeological features. The survey identified one positive linear of possible archaeological origin in the eastern side of the survey.

1.1.6 Overall the surveys undertaken at Chapelpark and Balavil obelisk and burial ground suggest a paucity of evidence for significant archaeology within the survey areas. However at Raitts Cave, a higher potential for archaeological features has been identified.

2. INTRODUCTION

2.1 Project Background

2.1.1 Transport Scotland is to carry out major infrastructure improvements to the A9 trunk road between Perth and Inverness. This will involve the dualling the existing stretches of single carriageway.

2.1.2 CFJV commissioned AB Heritage to undertake detailed geophysical survey to establish the likelihood of sensitive archaeological remains being present within areas affected by route alignment options being assessed in the DMRB Stage 2 reporting for the Crubenmore to Kincraig (Project 9) section of the A9 Dualling programme. The works at Raitts Cave were undertaken under Section 42 consent, issued by Historic Environment Scotland.

2.2 Archaeological Background

2.2.1 There are three survey areas; each area was chosen for geophysical investigation to understand its wider archaeological potential. The archaeological background of these areas is discussed below.

Raitts Cave

2.2.2 Located to the north of the A9 road at NH776019, the Scheduled Monument (No. 925) is recorded in the Highlands HER (MHG4405) as a *'horseshoe shaped earth-house discovered in 1835.'*

2.2.3 The Historic Environment Scotland Schedule describes the monument as 25 m in length and almost entirely subterranean. The passage is around 1.3 m wide and very well preserved.

2.2.4 A scheme of archaeological investigation was proposed in 1999 by Glasgow University Archaeological Research Division (GUARD) to survey the site of Raitts Cave both topographically and with geophysical techniques (in a similar though less refined way than proposed here). In their proposal GUARD described the monument thus:

'Today the souterrain...appears as a large, horseshoe shaped structure built into an upper break of slope in a natural terrace above the floodplain. Its eastern half is very well preserved, with curving drystone walls surviving to c. 2 m in height and a roof formed of large slabs. An entranceway from the south, at the deepest point of the horse-shoe curve, leads into it...At the shorter, western end of the horse-shoe, a narrow, low passage covered with a stone lintel leads to another aperture in the ground above.'

2.2.5 Souterrain monuments are quite rare and their use and function somewhat difficult to define. Functions have been variously argued for winter stalls for livestock, as refuges and shelters from danger, storehouses and even as religious installations. Excavations carried out on souterrains have usually proved inconclusive as to their likely function.

2.2.6 The entry in the Highland Council HER records the site as being of potential Iron Age date and of national importance with value for the enhancement of our understanding of prehistoric architecture and domestic life.

2.2.7 Souterrain monuments are not unknown in the Highlands, though most other examples are often straight or cruciform – some ending in rooms or cells. Despite being 'discovered' in 1835 by the Principal of the University of Edinburgh, this monument was already well-known to the locals of the Parish of Alvie and it is well known in local folklore.

2.2.8 It is hoped that the proposed survey of this site will determine the limits of the souterrain and the remains of other earthworks nearby and to identify any further archaeological remains (associated or otherwise) that could be directly affected by the proposed dualling works.

Balavil obelisk and burial ground

2.2.9 Located to the south of the A9 (NH 787020) this site comprises a B Listed Building (obelisk) and a surrounding burial ground. The site comprises a white marble obelisk, erected c.1796. It is surrounded by a stone wall topped with railings forming a circular enclosure with a single east facing, gated entrance. The obelisk was erected to the memory of James MacPherson who is remembered for his celebrated translations of the poems of Ossian.

2.2.10 The enclosure contains the remains of subsequent members of the MacPherson family from the 19th century. There is a chance that earlier remains may exist close to the current monument.

Chapelpark

2.2.11 Located immediately beyond the trees to the west of the obelisk and its clearing, lies an area of c.1.1 ha of pasture named Chapelpark. As the name suggests this land is known to have been the site of two chapels (now vanished). It is thought that Chapelpark and the clearing around the Balavil obelisk could contain evidence for burials or buildings/plots associated with the chapels.

2.2.12 The geophysical survey has the potential to produce evidence of hitherto unknown archaeological remains.

2.3 Site Location & Description

2.3.1 All of the locations of the sites are detailed below and are situated along the current route of the A9 and shown in Figure 1.

Raitts Cave

2.3.2 The site is located c.1 km to the west of Lynchat; and c.2 km to the east of Kingussie, and covers an area of c. 0.5 ha. It is located c.100 m north of the A9 road at NH 77670 01942.

2.3.3 The site is currently covered by pasture sits on a slope facing south with a maximum height of 260 m Above Ordnance Datum (AOD) dropping 10 m to the south.

Balavil obelisk and burial ground

2.3.4 The site is located within Lynchat and 2.5 km to the east of Kingussie, and covers an area of 0.3 ha. It is located 50 m to the south of the current A9 road at NH 78784 02035.

2.3.5 The site is currently situated on a hill with a height of 240 m AOD surrounded by trees, and covered by pasture.

Chapelpark

2.3.6 The site is located within Lynchat and 2.5 km to the east of Kingussie, and covers an area of 1.1ha. It is located to the west of Balavil obelisk and burial ground, and to the south of the current A9 road at NH 78600 01973.

2.3.7 It lies to the south of the A9 at a height of 220 m AOD. The majority of the site is currently covered by marshland with the rest of the field covered by pasture.

2.4 Geology & Topography

2.4.1 The geology of Scotland can limit the potential for the application of magnetometry to be successful in certain areas due to the large amount of igneous rock. Drift geology can also play an important factor in the outcome of positive results with alluvium/colluviums having the potential to mask archaeological features depending on the depth of features. In reality there are few areas within Scotland where magnetometry survey cannot be applied, and have the potential to find archaeological features (ScARF, 2015).

Raitts Cave

2.4.2 The bedrock of the site is Loch Laggan Psammite Formation, this is a metamorphic rock with superficial deposits of Ardverkie Till Formation (BGS, 2015). The soils covering the site are fluvioglacial and raised beach sands and gravels derived from acid rocks (Soils Scotland, 2015). This type of geology is not likely to cause any adverse effect to the collection of geophysical data.

Balavil Obelisk and Burial Ground

2.4.3 The bedrock of the site is Loch Laggan Psammite Formation, this is a metamorphic rock with glaciofluvial fan deposits gravel, sand, silt and clay (BGS, 2015). The soils covering the site are fluvioglacial and raised beach sands and gravels derived from acid rocks (Soils Scotland, 2015). This type of geology is not likely to cause any adverse effect to the collection of geophysical data.

Chapelpark

2.4.4 The bedrock of the site is Loch Laggan Psammite Formation, this is a metamorphic rock with Glaciofluvial Fan deposits gravel, sand, silt and clay (BGS, 2015). The soils covering the site are fluvioglacial and raised beach sands and gravels derived from acid rocks (Soils Scotland, 2015). This type of geology is not likely to cause any adverse effect to the collection of geophysical data.

3. AIMS AND METHODOLOGY

3.1 Aims of Survey Works

3.1.1 Geophysical survey is a programme of non-intrusive archaeological work. The aim of this programme of geophysical survey was to:

- Identify any geophysical anomalies of possible archaeological origin within the specified survey area
- Develop a better understanding of the extent of possible archaeological remains within the surrounding environs
- Accurately locate these anomalies and present the findings in map form
- Identify recommendations for any further archaeological work(s)

3.2 Summary of Methodology

Site Specific Information

3.2.1 Three sites - Raitts Cave *c.*2.5 ha; Balavil obelisk and burial ground *c.*0.3 ha; and Chapelpark c.1.1ha were investigated through non-intrusive survey.

3.2.2 The weather conditions for the work were varied with heavy snow to dry conditions. Snow can cause high resistance and create false readings. To account for this, the results were continuously checked, and where the results were thought to have been compromised the areas in question were re-surveyed.

3.2.3 Below is outlined the specific methodology for the intended techniques and equipment, for more detailed methodology please refer to Appendix A.

Magnetometer

3.2.4 The Bartington Grad 601-2 dual magnetic gradiometer is capable of surveying to an accuracy of 0.1 nanotesla (nT).

3.2.5 The magnetometer data is collected in 30 m x 30 m grids at a resolution of 1 m x 0.25 m. This sample density is recommended for site evaluation (English Heritage, 2008). This equates to 3600 points per 30 m x 30 m grid. The magnetometer has a typical depth of penetration of 0.5 m to 1.0 m. This would be increased if strongly magnetic objects are buried within the site.

3.2.6 The readings are logged continually by the data logger during the survey, which is then downloaded on site to a laptop computer. At the end of each job, data is transferred to the office PC's for processing and presentation.

3.2.7 This 'regular xy' data is then downloaded into specialist data processing software, at user defined sample intervals (in this case 1 m by 0.25 m). This is processed as standard magnetometer data.

Table 3-1: Setting Parameters of Magnetometer

Grid Size	**30x30 metres**
Data Capture Distances	1m x 0.25m
Sensors	2
Sensitivity	0.1nT

Resistivity

3.2.8 The resistance meter is an RM15 manufactured by Geoscan Research incorporating a multiplexer with a four probe array. The four probes are separated by 0.5 m and the associated remote probes will be positioned approximately 20 m outside the grid. The instrument uses an automatic data logger which permits the data to be recorded as the survey progresses for later downloading to a computer for processing and presentation. Though the values being logged are actually resistances in ohms they are directly proportional to resistivity (ohm-metres) as the same probe configuration was used throughout.

3.2.9 The Resistivity data is collected in a 30 m x 30 m grid at a resolution of 0.5 m x 0.5 m. The Resistivity has a depth penetration of 0.5 m to 1 m. This would be increased strongly in areas of high resistance.

GPS

3.2.10 During such a survey a Trimble GeoXR Differential Global Positioning System (dGPS), capable of Real Time Kinematic (RTK) is used to set out a nominal grid prior to the survey. This increases the accuracy and efficiency of the survey with an accuracy better than (+/- 0.1 m). The data is then downloaded from the unit on the day, using a SD card.

3.2.11 The magnetic survey equipment used was two Bartington Grad-601 (fluxgate magnetometers).Please see Appendix A, which contains a detailed methodology for the works undertaken; Table 1 below shows site specific information on how the magnetometer was set up:

3.2.12 A Trimble GeoXR GPS was used to setup the geophysical survey. This has sub-centimetre accuracy suitable to this survey.

3.3 Known Constraints

Raitts Cave

3.3.1 The site is situated on undulating terrain with raised banks and stones protruding from the surface. This can lead to possible stagger within the data, and difficulty traversing across these features.

3.3.2 The southern side of the site is bordered by metallic fencing along with the area of the souterrain currently surrounded by metallic fencing, this can cause magnetic disturbance within c.1-2 m.

Plate 1 Facing South in the Souterrain area

Plate 2 Snowy conditions in the souterrain area. Facing east

Balavil Obelisk and Burial Ground

3.3.3 The site is on top of a high protruding hill, with steep sides this can lead to stagger within the data when navigating the side of the hill. The area is situated within fairly dense woodland, and the roots of the trees can show up in the survey plots.

Plate 2 Balavil Obelisk and Burial Ground. View to north west

Chapelpark

3.3.4 The majority of the area for Chapel Park was covered with marshland and could not be surveyed, the area to the south was covered with pasture. The high water volume within the surrounding area made it unsuitable for resistivity.

4. RESULTS AND INTERPRETATIONS

4.1.1 Features have been categorised into [GP] numbers, and raw and processed data displayed in Figures 2-10 with interpretations shown in Figures 11-15.

4.1.2 Interpretation of the results of the geophysical survey is based on professional judgement as to the likely/probable cause of an anomaly or reading. For example, strong dipolar discrete anomalies of small size are often associated with ferrous debris or similarly magnetic debris. In addition, where a positive linear anomaly is recorded, which has a negative anomaly associated alongside either side of it, is often likely to relate to the line of a modern service.

4.2 Raitts Cave

4.2.1 Due to the likely shallow depth of the topsoil and geology of the site, there has been a high response to features identified within both techniques used. This can lead to a mixture of results, though also give a clear response for strong features.

Magnetometer

4.2.2 Due to the high response of features from the magnetometer survey across this site, features have been classified into ranges. This allows for a separation of likely geological features from archaeological features. It is assumed that the geological features display a weaker background variation with a non-uniform shape.

GP 1 Possible Archaeology ≤10nt

4.2.3 Features identified in the northern area of the survey, with a reading above 3nt are likely to have an archaeological association with the souterrain.

4.2.4 In the north western part of the site there appears to be a higher set of disturbances in relation to possible features, running in a fairly linear pattern. The features in general have a width of c.1-2 m with a length of up to c.20 m. These features could relate to possible linear banks or structures associated with the souterrain.

4.2.5 A feature of interest is a possible ‘right-angled’ feature located at the south eastern corner of the souterrain. This feature has a width of c-2-3 m and a length of c.60 m each side. Features identified around these anomalies have a reading of generally <5n; these features are less likely to be associated with the souterrain as they are further from it and are likely to be geological in nature.

GP 2 Geological ≤3nt

4.2.6 Multiple features have been located within the eastern side of the site running in a north to south direction. These features have readings of between 1-3nt and run in an irregular pattern down the slope to the south with a recorded length of up to c.90 m. These features are likely related to ancient water courses or palaeochannels.

Other GP3 10nt>

4.2.7 The site is bounded to the south and east by a post and wire fence. The remains of the souterrain were also enclosed with a post and wire fence. These fences have caused a magnetic disturbance of 1-2 m either side as shown on the figures and these have been classed as **[GP3].**

<u>Resistivity</u>

High Resistance

4.2.8 The northern area of the site is mainly high resistance, and is situated around the known remains of the souterrain with an average resistance of above c.1200 Ohms.

4.2.9 Within the southern side of the site there are features running south of the souterrain. These are linear features aligned east to west parallel with an extant bank.

Low Resistance

4.2.10 The lowest resistance area is situated within the south eastern part of the site, with a clear distinction of resistance from the higher resistance and an average of just above 800 Ohms. This may be suggestive of a possible change in the geology and could be an area of relict river levels.

4.3 Balavil Obelisk

4.3.1 The Balavil obelisk and burial ground is surrounded by a metallic railing, which caused significant magnetic interference. The surrounding woodland with its dense roots was also a source of interference.

<u>Magnetometer</u>

4.3.2 No features of possible archaeological origin have been identified within the survey area.

Other GP3 – GP4

4.3.3 Features identified within the south western corner of the site are highlighted as di-polar anomalies [**GP 4**], these features are situated within a square pattern and could be suggestive of previous modern features situated on the hill, or could even relate to removal of woodland.

4.3.4 The majority of the site contains metallic disturbance [**GP 3**], which is mainly related to the metallic fencing surrounding the obelisk.

<u>Resistivity</u>

High Resistance

4.3.5 High resistance of the site is mainly shown within the central gird of the resistivity survey with readings above 800 Ohms just to the eastern side of the obelisk. This is likely due to the fact that the area is composed of made ground.

Low Resistance

4.3.6 Low Resistance on the site is mainly in the eastern side, with a variation in readings around the wooded areas. This is to be expected with the majority of disturbance likely to be associated with the clearing on the top of the hill.

4.4 Chapelpark

4.4.1 The originally proposed site for the survey was covered by marshland at the time of the fieldwork, and was therefore ruled out. The area around the fringes of the marshland was surveyed, but was also waterlogged and this had a negative impact on results. Both areas of Chapelpark were unsuitable for resistance survey.

GP 1 Possible Archaeology

4.4.2 The survey showed a small linear c.30 m in length running in a north to south direction, with a reading of 2-3nt. This could relate to modern disturbance or could be of possible archaeological origin and relate to a cut and filled feature.

Other GP 3-4

4.4.3 Magnetic Disturbance [**GP3**] is located within the site and mainly associated with the metallic fencing surrounding the site.

4.4.4 Multiple Di-polar Anomalies [**GP4**] are situated in an irregular pattern throughout the site.

5. DISCUSSIONS AND CONCLUSIONS

5.1.1 A discussion of the results follows. Allied to the discussion is a rating of confidence of the results. In line with guidance from English Heritage (2008), it must be understood that such a confidence rating is subjective and fallible, all results can only really be tested through archaeological excavation.

5.2 Raitts Cave Souterrain

5.2.1 The souterrain is located within the centre of the surveyed area with a clear variation in topography throughout the site. To the south of the souterrain there is a clearly visible bank that is cut by a track that crosses through the site.

5.2.2 The magnetometer survey identified features that are likely associated with geological variation [GP2] throughout the site. There is a clear distinction of change from the northern half of the site to the southern half within the data. This is shown to be more distinct within the resistivity data and could be due to a possible change within the geology and may show previous water levels.

5.2.3 Based on the above ground stone and earthen banks it is likely the majority of the features identified are likely to consist of both stone and earth features which have been moved to create possible banks and features surrounding the souterrain.

5.2.4 From this geophysical survey there is a high confidence that the souterrain is shown to be more complex than just the fenced area. Possible subterranean features exist [GP 1] and continue along the lines of the known tunnels. The site also appears to be enclosed by a possible bank to south, which could return and enclose the eastern edge of the souterrain.

5.3 Balavil Obelisk and Burial Ground

5.3.1 The survey area does not appear to contain any major features of archaeological interest. An area that may warrant further investigation contains a set of di-polar anomalies [GP 2] shown in the south western side of the site in the magnetometer survey. These features are of likely modern origin and could relate to activities associated with the construction of the A9. Most likely relating to the removal of woodland, they appear not to have strong enough readings to be associated with burials.

5.3.2 The topography of the land is suggestive of the site being levelled in the past to allow for the erection of the obelisk. The results of the resistivity survey show the made ground around the obelisk, with the majority of results from the magnetometer data also showing the ground to be disturbed. There is a low confidence in the results from this survey as readings are likely to be heavily disturbed due to the levelling of the area and deforestation.

5.4 Chapelpark

5.4.1 The majority of the area designated for survey was covered by marshland and was therefore unsuitable for survey. An area to the south was surveyed to try and capture some landscape data.

5.4.2 The preferred technique was magnetometry. The survey has shown one positive linear [**GP 1**] of interest with the majority of the site clear of any identified archaeological features. There is a low confidence that this feature is likely to be of archaeological origin.

6. ARCHIVE

6.1.1 The Site Archive will contain the following, as a minimum:

Table 3: Site Archive Data

Archive	Format
Raw Geophysical Data files	XYZ and Text
Processed geophysical data files	JPEG, BMAP
Archaeological Interpretation	Shape Files ARC GIS
Final Report	PDF
Final Images	PDF

6.1.2 A physical and digital archive will be stored in a suitable format at AB Heritage Limited offices in Taunton, Somerset.

7. REFERENCES

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Appendix 1 Technical Information on Geophysical Survey

<u>**FLUXAGTE MAGNETOMETRY SURVEY**</u>

The 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.

<u>*Survey equipment*</u>

The Bartington Grad 601-2 dual magnetic gradiometer is capable of surveying to an accuracy of 0.1 nanotesla (nT).

<u>*Sample interval and depth of scan*</u>

The magnetometer data is collected in 30mx30m grids at a resolution of 1m x 0.25m. This sample density is recommended for site evaluation (English Heritage, 2008). This equates to 3600 points per 30mx30m grid. The magnetometer has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects are buried within the site.

<u>*Data capture*</u>

The readings are logged continually by the data logger during the survey, which is then downloaded on site to a site laptop. At the end of each job, data is transferred to the office PC's for processing and presentation.

This 'regular xy' data is then downloaded into specialist data processing software, at user defined sample intervals (in this case 1 m by 0.25 m). This is processed as standard magnetometer data.

<u>Processing</u>

Standard Magnetometer data processing consists of:

Zero mean Traverse- This process sets the background mean of each traverse within each grid to zero, the operation allows for the removal of striping effects.

Destagger- The collection of geophysical data can lead to errors with time due to a slight variation in speed of traverses or time lag within the collection of data. The process corrects the errors of stagger within the data.

Non-Standard Magnetometer processing:

Interpolation- The results of greyscale geophysical data can sometimes appear blocky in nature. Interpolation is a process which calculates and inserts values between existing data to give a smoother grey scale image.

Clipping – The clipping process will clip extreme values from the data set and increase the contrast in the data values closer to the mean. As most data within a data set is concentrated around the mean clipping can produce a better visualisation of standard data sets, particularly very weak signals that tend to be lost in a myriad of grey shades.

Some degree of heading error is inevitable when using a fluxgate gradiometer with such an acute sensitivity to the direction of travel in bi directional manner i.e. zigzag traverses. The error displays as a series of alternating lighter and darker stripes in the traverse direction and the function asses and corrects the mean for each line of data to bring them in to the same mean range and remove any visible artefacts.

Display of data

Greyscale-This is display takes a range of reading and divides into a set number of classes. Each class is represented by a specific shade of grey and the higher the positive reading the darker the grey.

Colour- Colour can be applied to Greyscale plots to show high and low data collection points in a more direct way.

XY Trace Plot- Data is represented by a line, which is incremented along the Y axis. This produces a stepped effect, thus the data can be viewed to show a possible shaping of a feature. Typically features are clipped to limit odd readings.

Assigned ranges can be adjusted to give the best display of the data.

Some degree of heading error is inevitable when using a fluxgate gradiometer with such an acute sensitivity to the direction of travel in bi directional manner i.e. zigzag traverses. The error displays as a series of alternating lighter and darker stripes in the traverse direction and the function asses and corrects the mean for each line of data to bring them in to the same mean range and remove any visible artefacts.

GPS METHODOLOGY

An RTK GPS (Real-time Kinematic Global Positioning System) can locate a point on the ground to sub-cm accuracy, a far greater accuracy than a standard GPS unit. An RTK system uses a base station receiver and a number of mobile units (rovers). The base station takes measurements from satellites in view and then broadcasts them along with its known position to the rover receivers. The rover receiver also collects measurements from the satellites in view and processes them with the base station data. The rover then computes its location relative to the base.

During such a survey a Trimble GeoXR Differential Global Positioning System (dGPS), capable of Real Time Kinematic (RTK) is used to set out a nominal grid prior to the survey. This increases the accuracy and efficiency of the survey. The data is then downloaded from the unit on the day, using a USB stick.

Appendix 2 Interpretation Categories

Categories for interpretations when there is corroborative evidence from desk based or excavation data can be assigned to magnetic anomalies (for example, Utility, Road, Wall, etc.) and where appropriate, such interpretations will be applied.

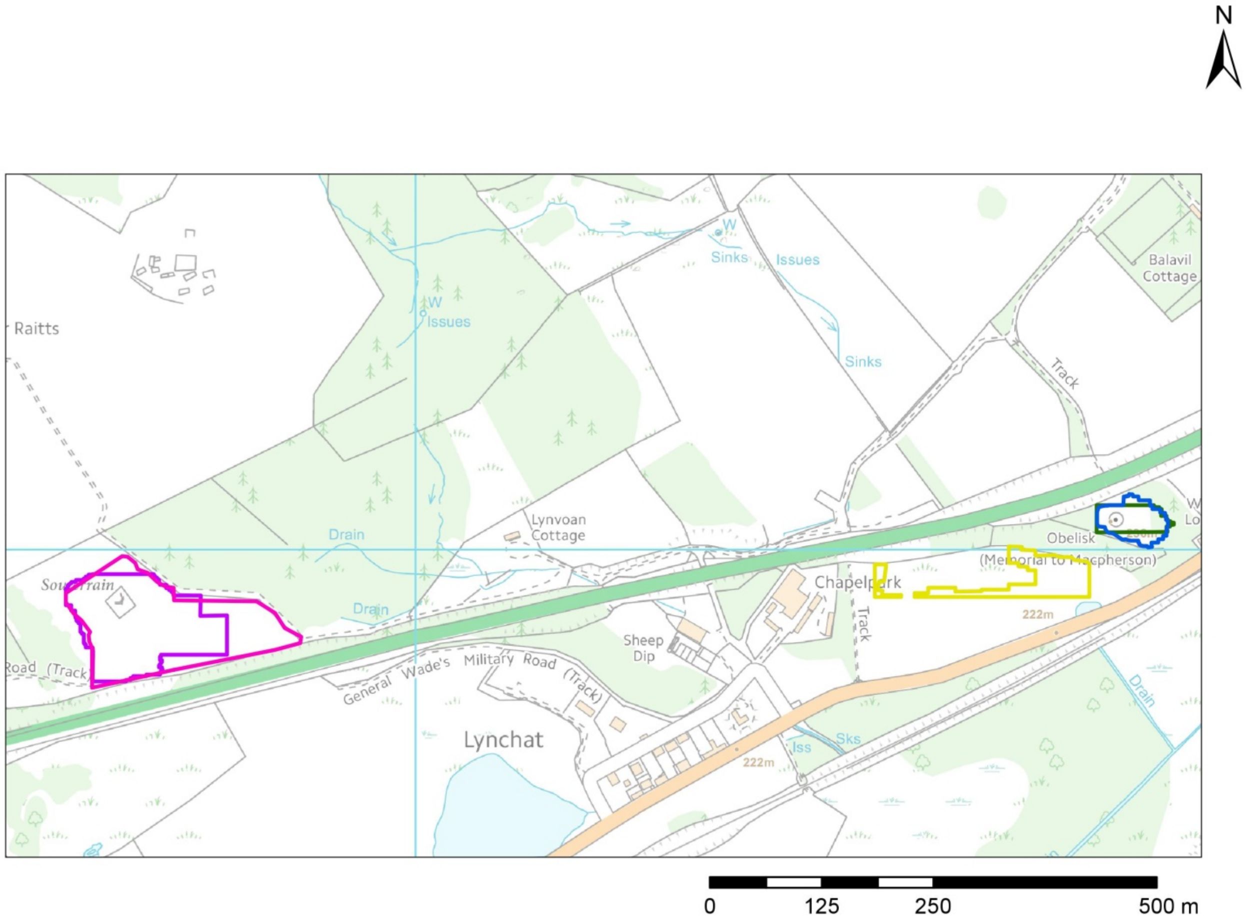
Below is a list of generic categories used for the interpretation of results. Features GP1-2 have a high confidence rating to be of archaeological potential where features GP3 – GP4 have a moderate confidence rating for interpretation.

GP1 Linear (Possible Archaeology) - This term is used when the form, nature and pattern of the response are clearly or very probably archaeological and most likely related to a ditch/cut feature.

GP 2 Geology - These responses form clear anomalies where variations produce magnetic distortions.

GP 3 Magnetic Disturbance- Magnetic strong dipolar anomalies, commonly found in places where modern ferrous materials are present. They are presumed to be modern.

GP 4 Di Polar - This type of response is associated with ferrous material and may result from small items in the topsoil, and sometimes larger buried objects.



Legend

- Soutterain Magnetometry Survey Area
- Soutterain Resistivity Survey Area
- Balavil Obelisk Magnetomerty Survey Area
- Balavil Obelisk Resistivity Survey Area
- Chapelpark Survey Area

Figure 1: Site Location

Project: A9 Dualling

Date: 25/11/15	Job Number: 50000
Drawn by: ZE	Approved by: GR

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Figure 2: Raw Magnetometry Data

Project: Raitt's Cave, Soutterain - A9 Dualling

Date: 02/12/15	Job Number: 50000
Drawn by: ZE	Approved by: GR

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0 25 50 100 m

N

Legend

Souterrain Magnetometry Survey Area

+6

Plotting Parameters

-6

Figure 3: Processed Magnetometry Data

Project: Raitt's Cave, Souterrain - A9 Dualling

Date: 25/11/15	Job Number: 50000
Drawn by: ZE	Approved by: GR

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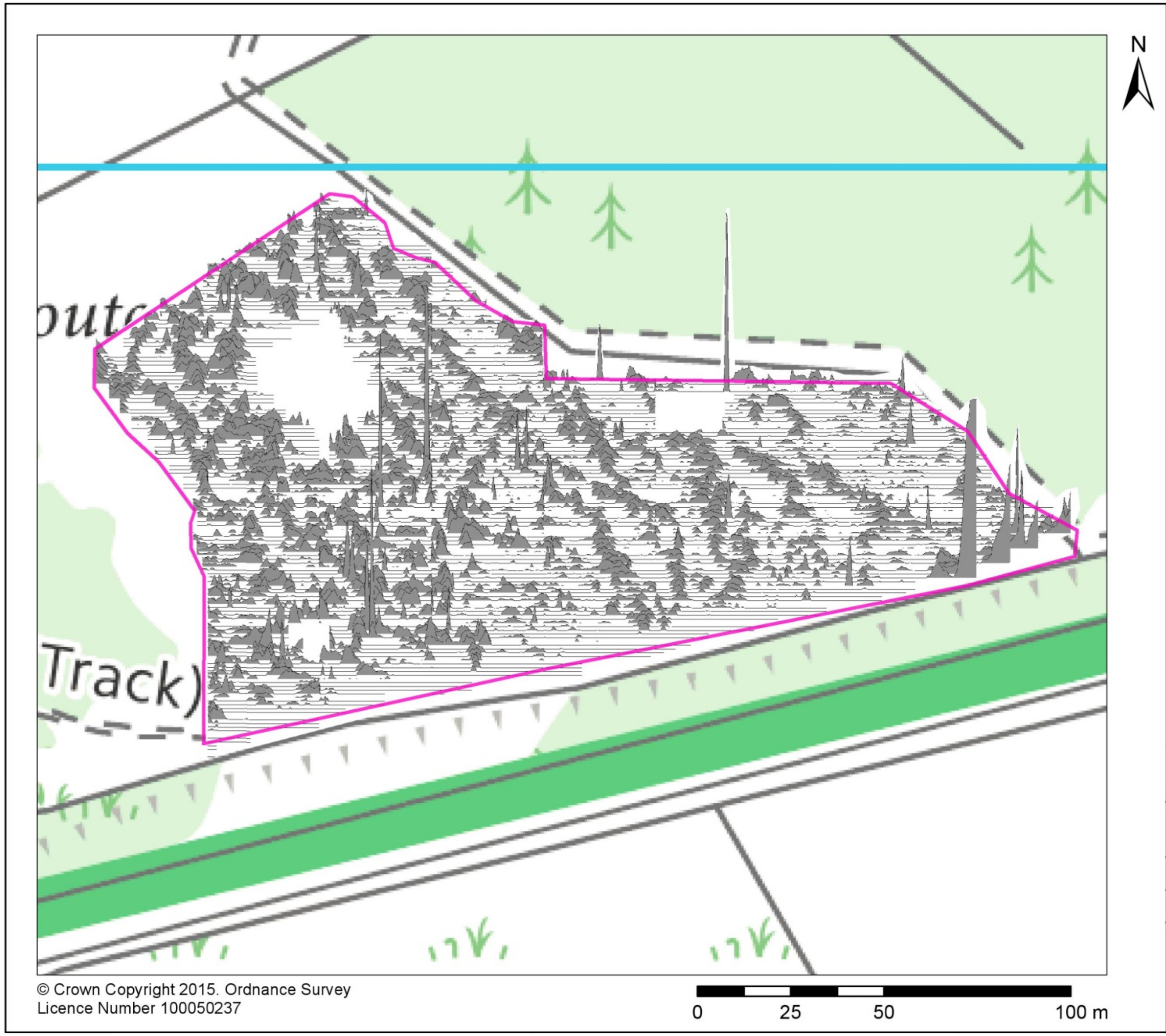

Figure 4: Trace plot of Magnetometry Data

Project: Raitt's Cave, Souterrain - A9 Dualling

Date: 03/12/15	Job Number: 50000
Drawn by: ZE	Approved by: GR

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N

Legend

Souterrain Resistivity Survey Area

1750
100
Plotting Perameters (ohms)

Figure 5: Resistivity Data

Project: Raitt's Cave, Souterrain - A9 Dualling

Date: 03/12/15	Job Number: 50000
Drawn by: ZE	Approved by: GR

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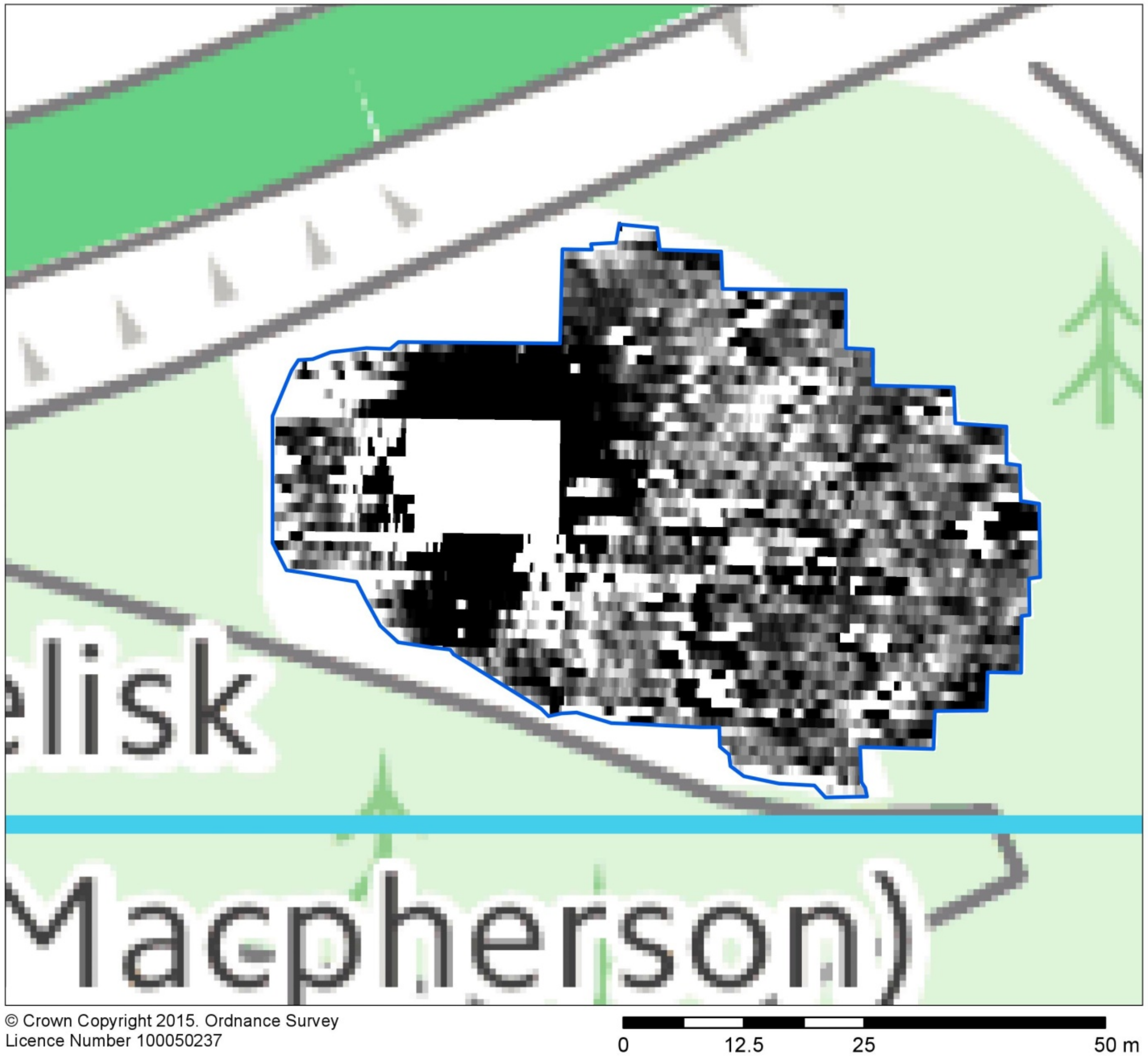
0 25 50 100 m



Legend

Balavil Obelisk Magnetomerty Survey Area

+2
-2
Plotting Parameters

Figure 6: Raw Magnetometry Data

Project: Balavil Obelisk - A9 Dualling

Date: 25/11/15	Job Number: 50000
Drawn by: ZE	Approved by: GR

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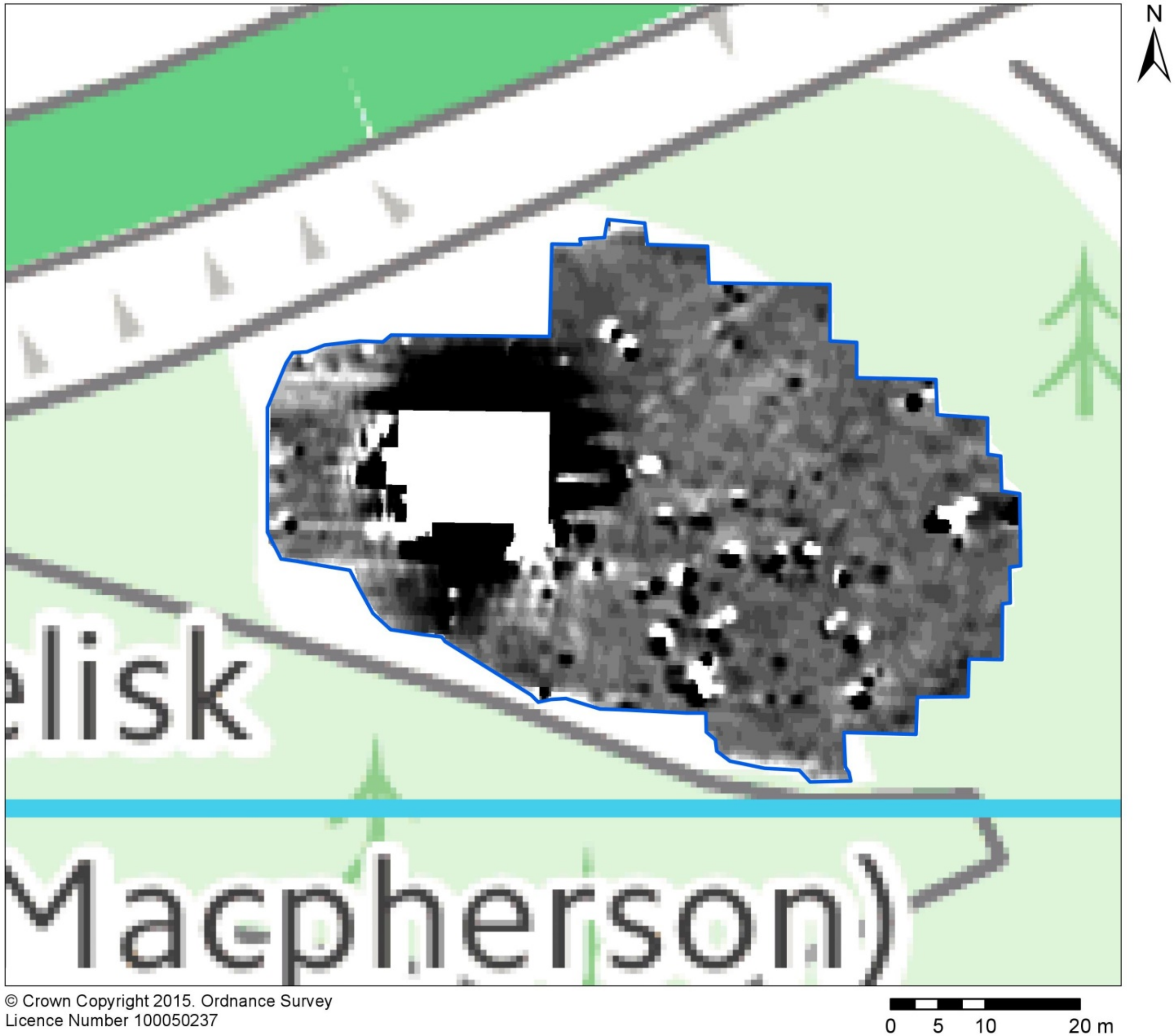

Figure 7: Processed Magnetometry Data	
Project: Balavil Obelisk - A9 Dualling	
Date: 25/11/15	Job Number: 50000
Drawn by: ZE	Approved by: GR

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N

Legend

Balavil Obelisk Resistivity Survey Area

250

Plotting Parameters

1700

0 5 10 20 m

Figure 8: Resistivity Data

Project: Balavil Obelisk - A9 Dualling

Date: 25/11/15	Job Number: 50000
Drawn by: ZE	Approved by: GR

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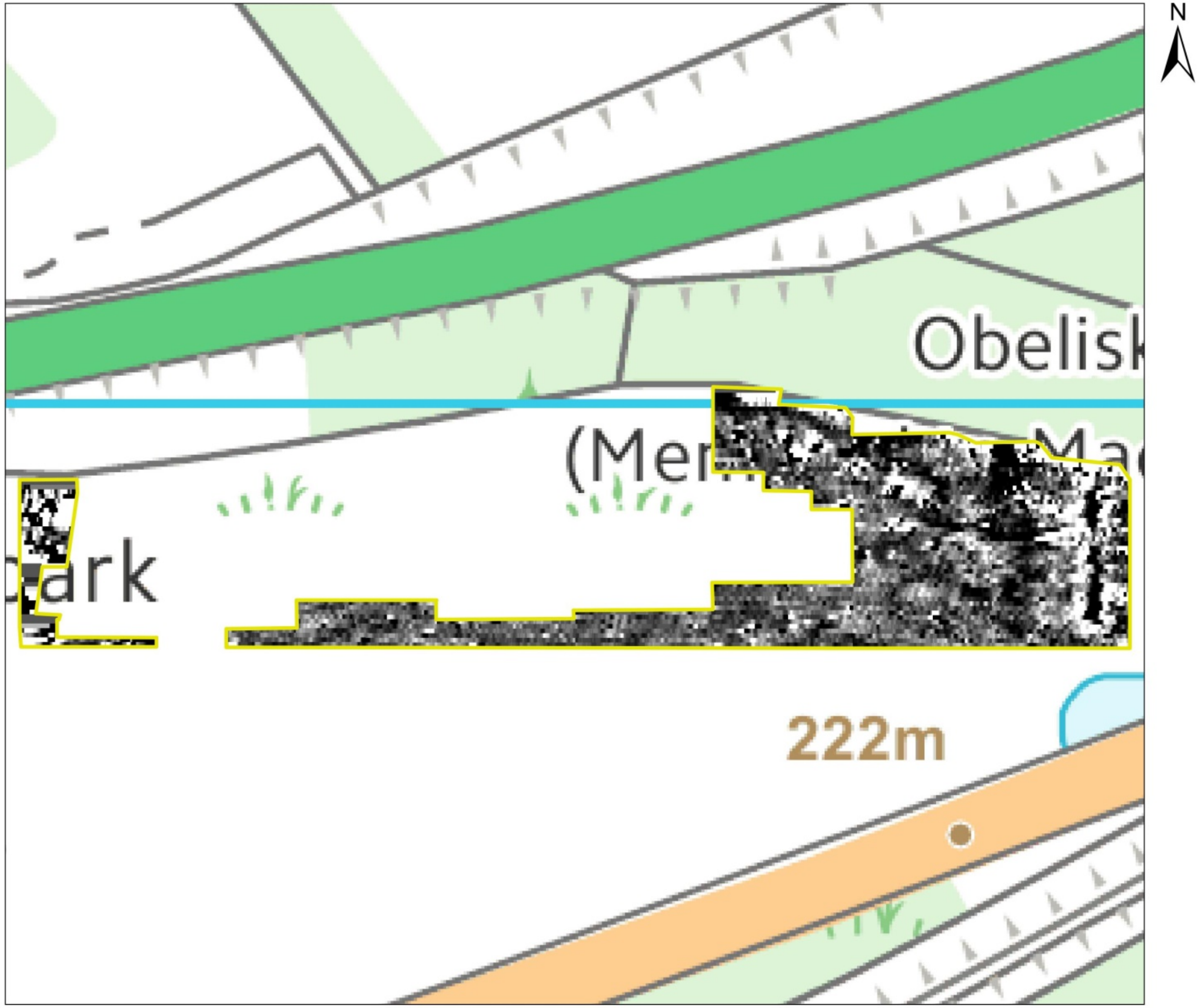

Legend

Chapel Park Survey Area

+2

Plotting Perameters

-2

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0 25 50 100 m

Figure 9: Raw Magnetometry Data

Project: Chapel Park - A9 Dualling

Date: 25/11/15	Job Number: 50000
Drawn by: ZE	Approved by: GR

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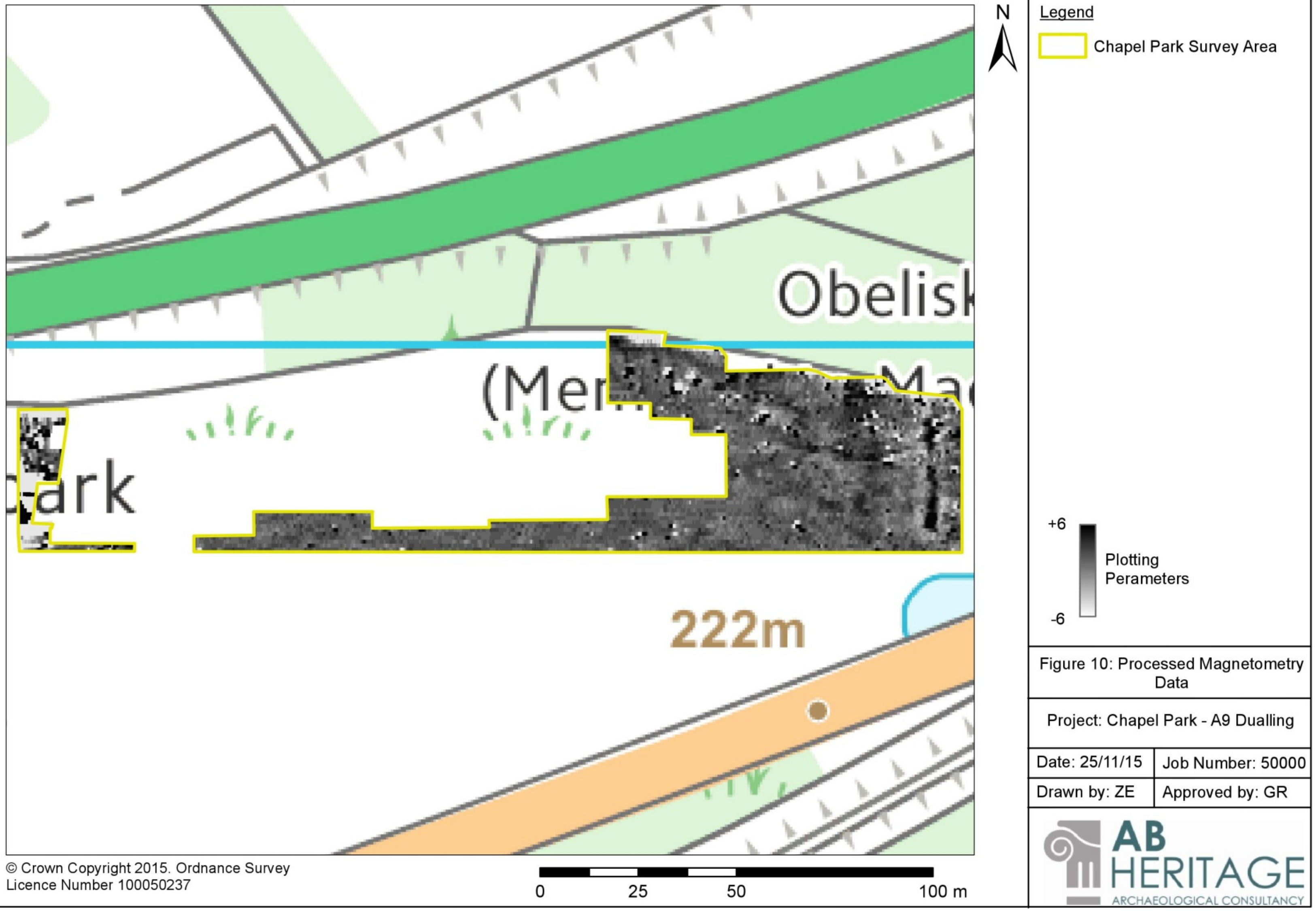

Figure 10: Processed Magnetometry Data

Project: Chapel Park - A9 Dualling

Date: 25/11/15	Job Number: 50000
Drawn by: ZE	Approved by: GR

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Legend

- ⩽3nt [GP2]
- ⩽10nt [GP1]
- Magnetic Disturbance ⩾10nt [GP3]
- Soutterain Magnetometry Survey Area

Figure 11: Interpretation of Magnetometry Data

Project: Raitt's Cave, Soutterain - A9 Dualling	
Date: 03/12/15	Job Number: 50000
Drawn by: ZE	Approved by: GR

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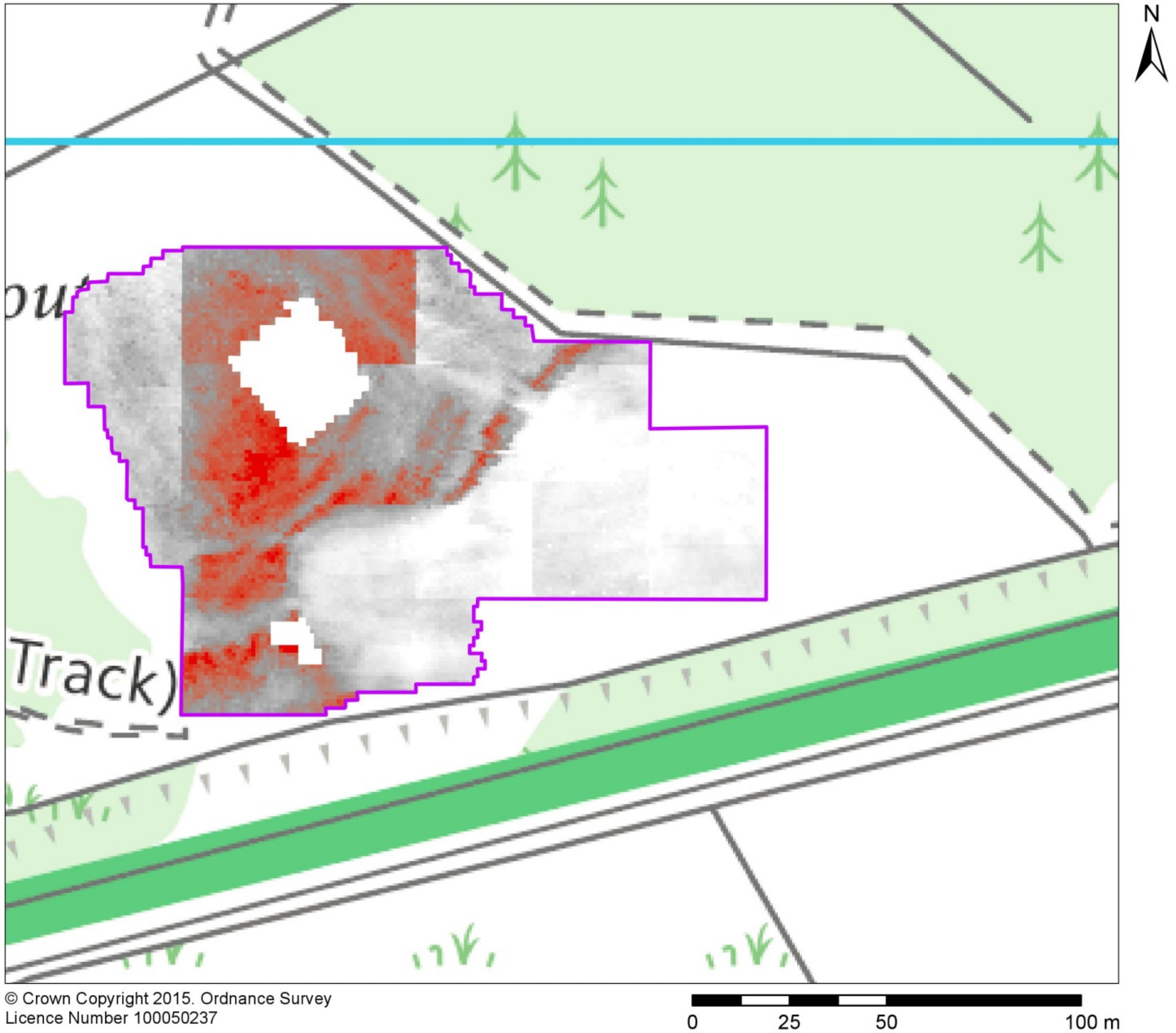

Figure 12: Interpretation of Resistivity Data

Project: Raitt's Cave, Soutterain - A9 Dualling

Date: 04/12/15	Job Number: 50000
Drawn by: ZE	Approved by: GR

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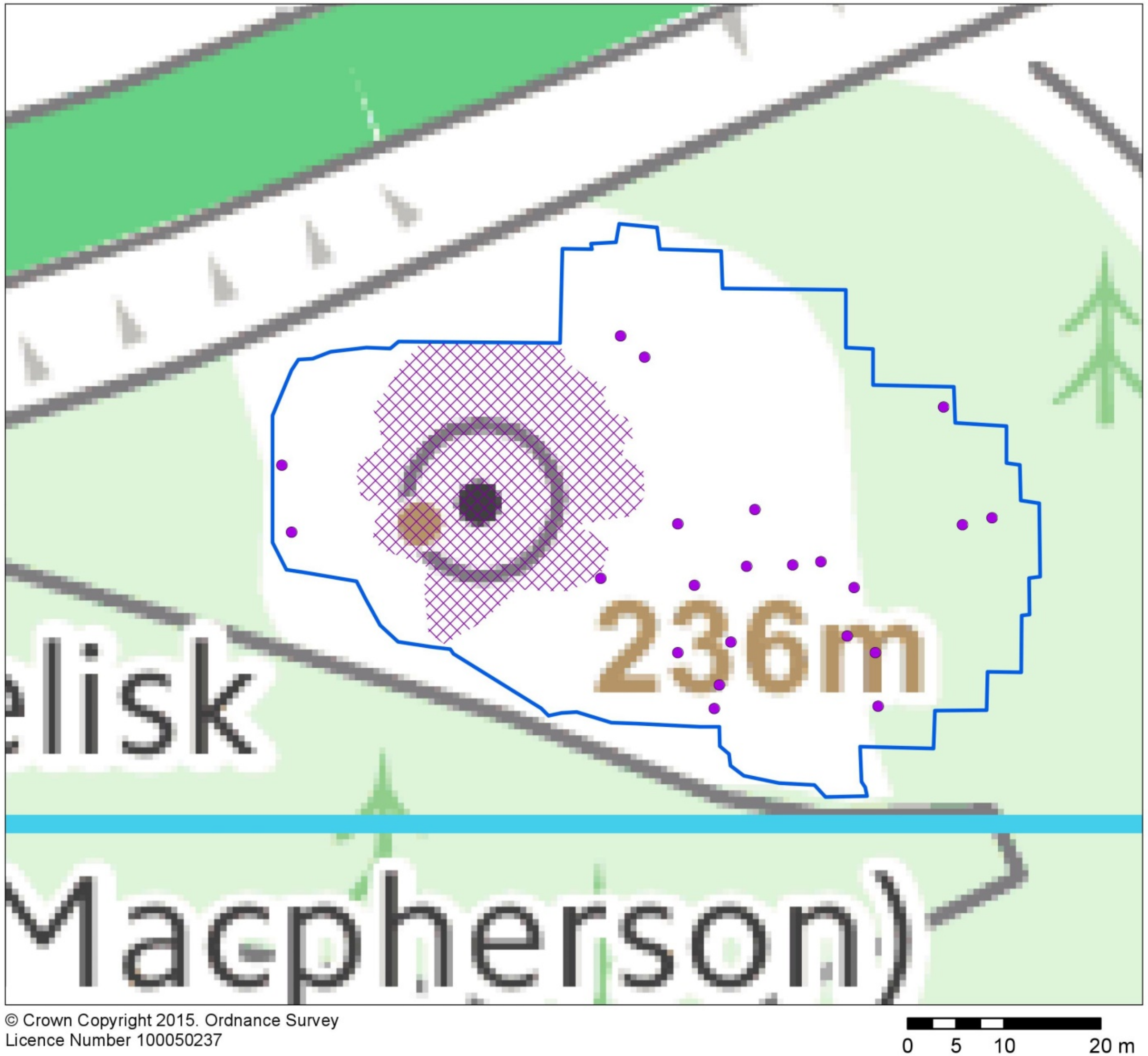

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Legend

- Magnetic Disturbance [GP3]
- Di-Polar Anomalies [GP4]
- Balavil Obelisk Magnetomerty Survey Area

Figure 13: Interpretation of Magnetometry Data

Project: Balavil Obelisk - A9 Dualling	
Date: 25/11/15	Job Number: 50000
Drawn by: ZE	Approved by: GR

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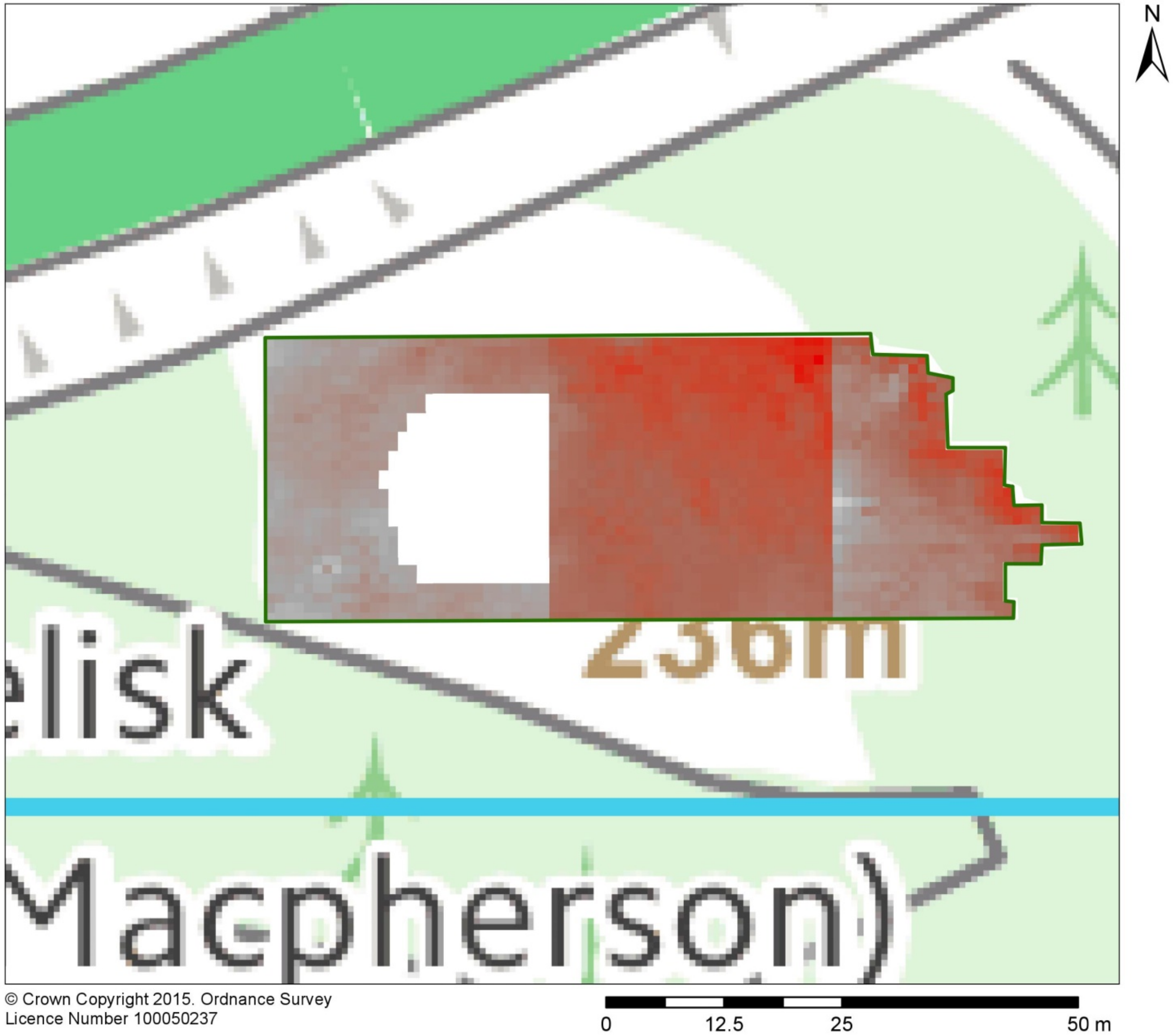

Legend

Balavil Obelisk Resistivity Survey Area

Low Restistance

High Resistance

Figure 14: Interpretation of Resistitivty Data

Project: Balavil Obelisk - A9 Dualling

Date: 04/12/15	Job Number: 50000
Drawn by: ZE	Approved by: GR

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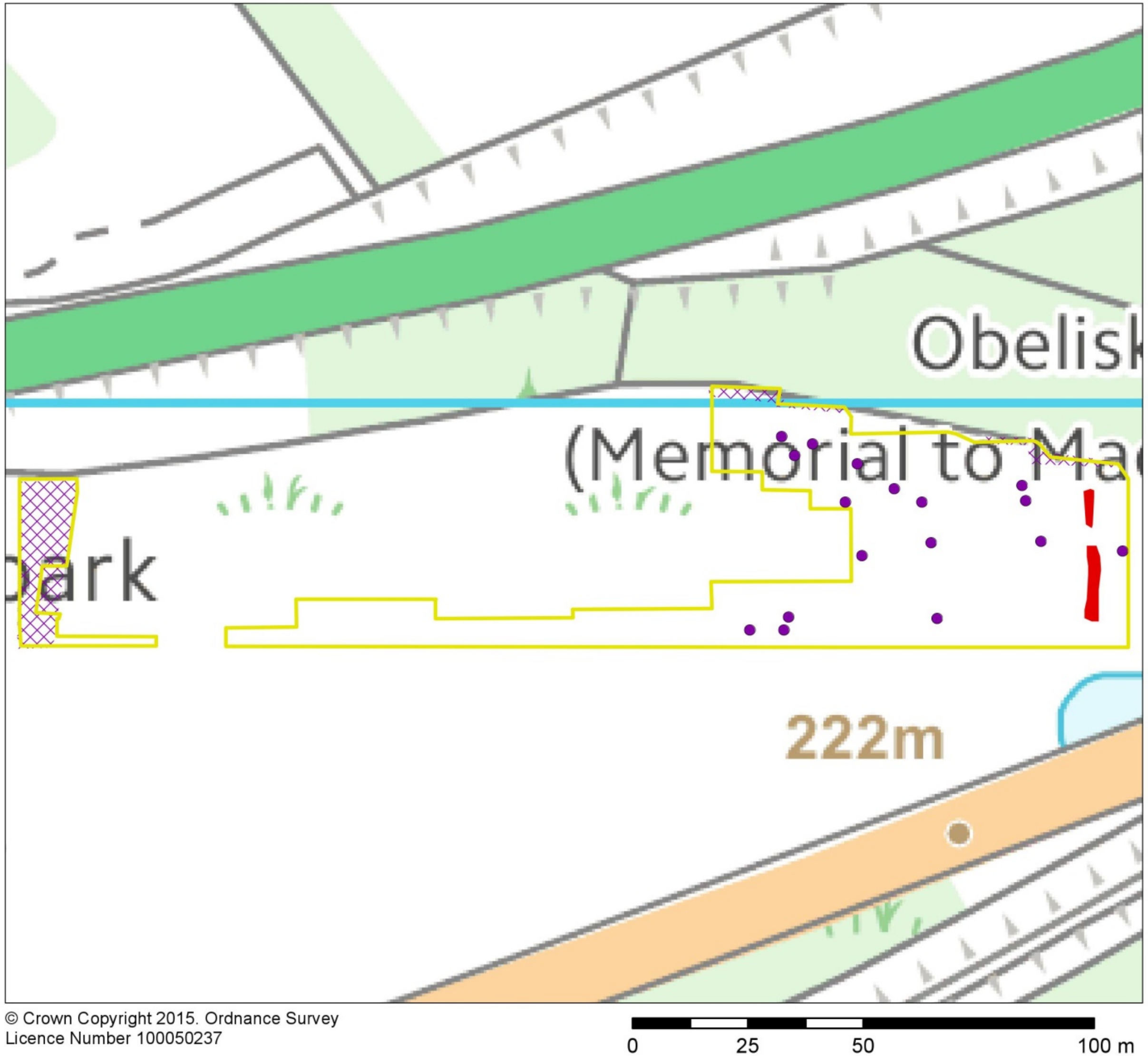

Legend

- Possible Archaeology [GP1]
- Magnetic Disturbance [GP3]
- Di-Polar Anomalies [GP4]
- Chapel Park Survey Area

Figure 15: Interpretation of Magnetometry Data

Project: Chapel Park - A9 Dualling

Date: 25/11/15	Job Number: 50000
Drawn by: ZE	Approved by: GR

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