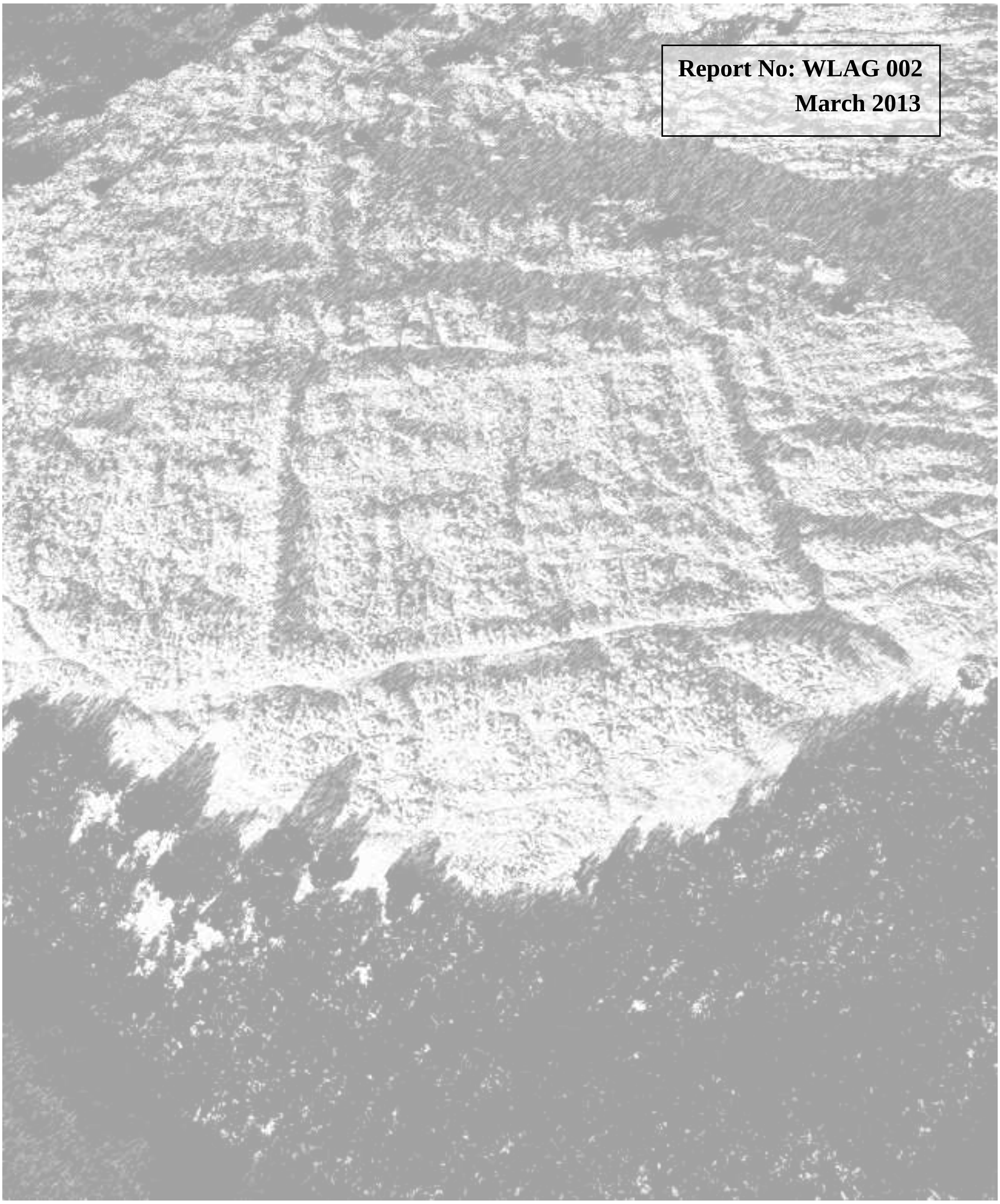
Gormyre Camp

A Multidisciplinary Approach

Survey & Excavation Report



Report No: WLAG 002
March 2013

Gormyre Camp, Torphichen

Survey & Excavation Report

West Lothian Archaeology Group Report No: WLAG 002

National Grid Reference (NGR): NS 97605 72665

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Date of Fieldwork: 2008 - 2012

Date of Report: 4th March 2013

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Summary

A series of geophysical surveys were carried out on the 16th July and 31st October by the Edinburgh Archaeology Field Society and additionally by the author on 8th of September 2010, on the summit of Gorymyre hill east of Torphichen. The works were carried out to ascertain the nature of the supposed Roman Camp on the summit of the hill as shown on early maps. The earth resistance and magnetic data identified no obvious features and is dominated by the nature of the localised geology and surface vegetation. Further surveys were carried out using a metal detector, field walking and continued seasonal monitoring of the area using kite aerial photography. Final intrusive excavation was carried out by members of EAFS and WLAG in September 2012. The findings proved negative in locating any significant archaeological finds or deposits. The conclusions suggest that Gormyre hill is part of an older agricultural landscape, with a possible later turf enclosure on the summit.

Acknowledgements

I would like to thank the members of the West Lothian Archaeology Group and Edinburgh Archaeological Field Society for all their dedication and hard work. I would also like to thank Dr Peter Morris and RCAHMS for their help. Finally Mrs H Coward of Wester Gormyre farm for permission to carry out the surveys and excavation.

Dedicated to the memory of Rosie Wells 1949 - 2013

Dedicated to the memory of Thomas Anderson 1964 - 2012

1 Introduction

1.1 Background

1.1.1 The area known as Gormyre encompasses pastoral farmland and a small range of hills within the historic parish of Torphichen near Bathgate. The Torphichen hills (locally referred to as the 'knuckles') are formed of five distinct rocky outcrops to the north east of the village. The eastern most hill is the highest (224m) and overlooks the others with commanding views across the West Lothian landscape. Upon the summit are a series of raised banks that have been described in the past as the remains of a possible Roman Camp. A number of field investigations have been carried out by both the West Lothian Archaeological Group and the Edinburgh Archaeology Field Society. These have included field walking, metal detecting, kite aerial photography, geophysical survey, area survey and culminating in 2012 with a small trial excavation to try and ascertain the nature of these features. The results of these will be discussed below.

1.2 Site Location

1.2.1 The site (centred on NGR: NS 9761 7267) is currently rough fallow ground, generally used by walkers and occasionally grazing for horses. It lies 889 metres NW of Torphichen village (NS 96768 72473) and 302 metres south of Wester Gormyre farm. To the south west of Gormyre hill is a possible prehistoric hill fort known as Castlethorn (NS 97430 72445). The site on Gormyre hill is bounded by a stone wall and mature trees to the east, west and north by a natural cliff edge. The summit of the hill provides an excellent all round viewpoint. Less than a mile to the south east can be seen the ancient burial complex of Cairnpapple (NS 9872 7173). A mile to the north is Bowden hill fort (NS 9775 7440) and Cockleroy hill fort (NS 98940 74380).

1.3 Historical and Archaeological Potential

1.3.1 Torphichen (NS 96768 72473) is rich in history. The origin of the name 'Torphichen' is suggested to come from the Brythonic Welsh for 'Hill of the Crows' or more likely, 'Hill of Fechan'. It is said that St Ninian or more likely one of his followers St. Vigeon (pseudonym St. Fechan), established a wooden church here in the 5th century AD (Smith 1997, 8). A few hundred years later in 1153, the Knights Hospitaller of St. John made their Scottish headquarters at Torphichen on the site of the former church. Today all that remains of the former Preceptory (NS 96894 72516) is the crossing and transepts with a later 17th century parish church built on the site of the nave. To the east are the Torpchichen hills. On the summit of the second lowest hill are the remains of Castlethorn hillfort (NS 97430 72445). The highest part of the knoll is surrounded by a low bank and on the north a second bank takes in a lower terrace. The entrance lies to the west, and the track way leading from it is marked by two standing stones. There are numerous other stones around the knoll which could constitute a stone circle.

The highest of the Torphichen hills is known as Gormyre hill. An account from the rental book of the Knights of St John of Jerusalem at Torphichen, indicates there were tenants at Gormyre during 1539-1540 (Cowan *et al* 1983). The earliest maps of this period show nothing in the Gormyre area and by the mid 1700's Roy's lowland map show a farm steading in the area. The first edition OS map of 1843-1882 shows Gormyre hill with an enclosure on its summit. The caption next to the sub-rectilinear enclosure reads 'Remains of Camps – Supposed Roman'. This is the first indication of a feature on the hill. As late as the 1960's the OS maps still recorded the feature as an earthwork, but by the late 1980's the feature had been re-classified and removed from the modern map. The enclosure could be related to the hill fort, the Romans as a marching camp or the Knights of St John as part of a monastic grange. It is the aim of this project to ascertain its nature.

1.3.2 *Archaeological Notes of Interest*

A nearly square enclosure on Gormyre Hill, known locally as the "Roman Camp". Its outline is now very faint, consisting of an earthen bank c. 1' high. Nothing has been found in it, and there are no associated traditions.
Name Book 1854

There is now no trace of this enclosure, except perhaps two low parallel lines of mound, hardly worth recording. Inventory of Monuments in West Lothian, RCAHMS, 1929.
Possibly the structure was no more than a cattle fold.
RCAHMS 1929, visited 1923; MSS, 1953

The remains of a rectangular enclosure, consisting of a low earthen bank, near the summit of Gormyre Hill. It has been built on top of rig-and-furrow and is clearly of later date. Some 80.0m to the NE are the remains of a similar such structure. Neither of these is an antiquity.
Visited by OS (JP) 14 August 1974

1.4 Site Objectives

1.4.1 The objective of the surveys and trial excavation was to locate and identify any possible archaeological features within the area of interest.

1.5 Site Methodology

1.5.1 Field Walking

The entire Gormyre hillside was walked systematically using a simple traverse. A series of survey ranging poles were set out at 5m intervals at either end of the landscape and traversed to and from in a zigzag fashion. Any finds that were retrieved, would be examined and recorded. Any find locations were recorded using a hand held GPS device and plotted onto a suitable map.

1.5.2 Metal Detecting

The hillside was also covered with a detailed metal detector survey. The grid layout is the same as the field walking, using the ranging poles spaced 5m apart and walking towards them using the metal detector to locate any surface/subsurface finds. Any objects of interest were carefully excavated, examined and recorded. Again, the location was recorded using a hand held GPS device and plotted onto a map.

1.5.3 Kite Aerial Photography

Aircraft are routinely used to photograph areas of archaeological interest. This methodology is expensive and not easily available to the general public. One method that is cheaper, fun and accessible by all is the use of kite aerial photography. A kite can be flown anywhere with the permission of the landowner and within legal boundaries. The use of kites suspended with a camera from the kite string has been employed by scientists and photographers for over a century. A simple camera fitted with a device to hold in the shutter release either electronically or manually can take hundreds of images flown over an area. The images can be joined together to form a large mosaic across the landscape or provide single images of potential features.

1.5.4 Earth Resistance Survey

The use of resistance soil measurements were carried out in order to locate any archaeological features. The use of resistivity is considered an effective method of delineating any possible pits or ditches present. A large area earth resistance survey was carried out by EAFS. Later a more targeted survey was carried out by WLAG. This was perpendicular to the original, in order to strengthen the results of the previous data. A more detailed description of the resistance survey method is detailed below.

The local geology divides the field into two areas. The northern half of the field has no superficial deposits and the southern half of the field is formed of raised tidal flat deposits, late devensian - silt and clay. The underlying bedrock is composed of dinantian to westphalian sills of Lothians and Fife - olivine analcime-microgabbro. (http://www.bgs.ac.uk/education/geology_of_britain/home.html)

1.5.5 Magnetic Survey

A detailed magnetic survey can be used effectively to delineate areas of former human occupation and agricultural activity by recording contrasts in the magnetic properties of soils and natural geology. An instrument such as a magnetometer can be used to detect potential archaeology. A magnetometer will induce a small magnetic field within its localised area. This magnetic field is affected by the anomaly within it. These anomalies can be on or below the surface as the instrument is moved along the survey area and any changes to the magnetic field are recorded within the device. Under favourable conditions a magnetic instrument is likely to detect anomalies such as iron, bricks, tiles, burnt material, ditches, pits, hearths, kilns, furnaces and ovens.

1.5.6 Total Station Survey

A total station survey was carried out during the trial excavation, to record features, trench locations and also a topographic survey of the localised area. The data could then be transformed into a surface model to examine the data further.

1.5.7 Trial Excavation

A number of small 1x1m test pits were entered in and around the feature. A further trench 1x4m was put across the western bank. All of the pits were dug by hand and recorded stratigraphically. The results were recorded as part of a paper and photographic record. The location of the pits and trench were recorded using a dedicated total station.

2. Methodology

2.1 Date of Fieldwork

2.1.1 The general field walking was carried out over a number of years when the vegetation was at its lowest during the winter months. The metal detecting survey was carried out in October 2009 under favourable conditions. The EAFS ground resistance surveys were carried out 16th July and additionally on 31st October 2009. The magnetic survey was carried out by Dr Peter Morris. The weather was generally fine with showers for the duration. The WLAG ground resistance survey was carried out on the 8th September 2010. Again the weather on the day was fine. The kite aerial photographic surveys were carried out over a number of years, during different seasons to try and identify features under variable conditions. The topographic survey and trial excavation were carried out by members of WLAG and EAFS on 25-26th of August 2012. The weather was variable.

2.2 Grid Location

2.2.1 The location of the survey area can be seen below in figure 16 with the origin located at NS 97647 72667. The earth resistance survey carried out by EAFS using the TR/CIA meter was carried out over an area of 3600 m^2. The magnetic survey carried out by Dr Morris was carried out over the same grid. The WLAG earth resistance survey using the 216M was carried out over an area of 1600 m^2. This incorporated a more targeted survey over just four grids to the south-west of the main area.

2.3 Description of Techniques and Equipment Configuration

2.3.1 Metal Detecting

The metal detector used for the survey was a Teknetics Omega 8000. This is an excellent mid-range metal detector and has a good depth of penetration. The detector was not set to metal discrimination, so would detect all metal types.

2.3.2 Kite Aerial Photography

A Premier Kites Power Sled 24 kite fitted with a Canon S90 and a Fuji Finepix F30fd (converted for near infra-red) were fitted onto a 360 degrees rotating frame. The use of infrared will help bring out features not readily seen in the visible spectrum. The kite is flown at a height under 60m with the camera rig rotating one full revolution every minute. It stops every four seconds and the canon is programmed to take an image every 4.5 seconds, with the Fuji taking images every second until the memory card is full.

2.3.3 Total Station Survey

The topographic survey was carried out using a Nikon 730 DTM. A second person carried the prism attached to a pole and 3D data was recorded at 5m intervals across the landscape. The collated data was downloaded into a personal computer and processed using powerful gridding software called 'Surfer' 7 (Golden Software Inc.) to produce a surface model to compare data against.

2.3.4 Earth Resistance Survey

This technique relies upon the ability of the soil to be able to conduct an electrical current passed through it. This in turn is affected by the moisture content, porosity of the soil, underlying geology and any other anomaly within this complex matrix. If an electric current is passed through the soil it will find the easiest path of least resistance, such as through a moisture retaining ditch (more conducting). The resulting resistivity response will therefore be low. Like wise the electrical current will find it more difficult to flow through a more dense structure such as a stone wall (more insulating) and will find an easier path by flowing around it. The resulting resistance response in this case would be expected to be higher. These two examples are can be considered our extremes and any anomalies differing in conductivity will produce varying results.

2.3.5 Earth Resistance Meter 216M

The WLAG earth resistance survey employed the use of MM Instruments 216M earth resistance meter incorporating a twin probe array. The mobile probes are set at a fixed distance of 0.5m with the remote probes set at a minimum distance of 15m outside of the nearest grid edge in order to reduce background resistance and variation. The 216M uses an internal data logger so that the information collected can be recorded automatically as the survey progresses and can be downloaded later to a computer for processing and interpretation.

The collected data was initially measured in volts and converted later to ohms within a Microsoft Excel template during the processing phase. The results can be considered in ohm-metres as this is directionally proportional to resistivity due to the probe placements being the same distance apart through out the survey. This relationship is important if we want to calculate an estimated depth of an anomaly.

2.3.6 Earth Resistance TR/CIA meter

The TR/CIA (EAFS survey) area ground resistance equipment operates the same as the 216M using the 'twin probe' configuration. Again, the mobile probes are set at a fixed distance of 0.5m with the remote probes set at a minimum distance of 15m outside of the nearest grid edge in order to reduce background resistance and variation. The meter also uses an internal data logger so that the information collected can be recorded automatically as the survey progresses and can be downloaded later to a computer for processing and interpretation.

2.3.7 Magnetic Survey

Theory suggests that electrical currents circulating deep within the earth act to produce the earth’s magnetic field. The effect can be thought of as a large bar magnet at the centre of the earth with opposing poles. The earth’s magnetic field can be described as uniform in both strength and direction. The overall magnitude of the field strength is around 50,000 nT (nanoTesla) and can vary due to its location and other factors causing fluctuation, such as diurnal variation and solar flaring.

There are two types of magnetic effects that can be used for the detection of anomalies of archaeological origin.

1) Thermoremnant Magnetisation – Iron is a naturally occurring earth element found in the geology of rock, clay and soils. Thermoremnance is a permanent form of magnetisation caused when magnetic minerals are heated above their Curie point (between 500 to 700 degrees Celsius) and become completely demagnetised. As the minerals cool down they become re-magnetised by the earth’s magnetic field and produce a fixed and coherent permanent magnetisation. In an archaeological context this effect can create strongly magnetic forms, such as hearths and kilns, which are detectable using the appropriate methodologies.

2) Magnetic Susceptibility – A general soil can be considered as being weakly magnetic due to the presence of iron compounds in the presence of a magnetic field i.e. the Earth’s magnetic field. The lack of a magnetised field will produce little or no magnetic effect. Magnetic properties within soil can be enhanced from a weaker to a stronger form through heating at low temperatures. This could have been caused by a domestic hearth or an agricultural process, such as slash and burn. Another process of enhancement can also be caused by fermentation through organic decomposition and also through bacterial action (microbactactic bacteria). These processes are poorly understood and more research is required.

Whether magnetism in archaeological features results from either thermoremnance or magnetic susceptibility, the resulting magnetic field will interact with earth’s ambient field producing positive and negative anomalies respectively. It is these anomalies that the archaeological geophysicist can detect using instruments called magnetometers. Magnetometry is a passive detection method which relies on the presence of the earth's magnetic field. Anomalies caused by human action and natural features are also detected. A particular type of magnetometer called a fluxgate gradiometer is of particular use to the archaeologist.

2.3.8 Fluxgate Gradiometer

The magnetometry survey was carried out using a Grad 601 vertical component fluxgate gradiometer by Bartington Industries Ltd. This instrument is a dual sensor instrument that employs the use of magnetic field strength detectors called fluxgates. The sensors are simple iron cores (mumetal) wound with copper wire. These are arranged one above the other at 50cm or 1m apart. The positioning of the sensors, where one is closer to the ground will be more affected by an anomaly than the other. The difference in readings between the sensors should effectively cancel the earth's magnetic field in the higher sensor and record the detected anomaly from the lower. A gradiometer basically measures the difference or gradient of the magnetic field rather than the total field strength. The gradiometer sensors effectively measure the magnetic field continuously. Any movement of the sensors during the survey will cause the readings to change and are also sensitive to any changes in temperature. These effects have to be accounted for every so often by making sure the sensors are in balance with one another in relation to the earth's magnetic field.

2.3.9 Trial Excavation

After examining all the survey evidence it was decided to insert a number of hand dug test pits and a single trench across the area of interest. All stratigraphic information was recorded on dedicated recording sheets. All test pit sections and plans were drawn at a suitable ratio on drawing film. Next they were recorded photographically and the location of the pits/trench were recorded using a dedicated total station.

The aim of the excavation was to evaluate the interior and exterior of the feature by taking the test pits down to bedrock in order to look for datable or diagnostic material, and assess preservation. The location of the pits can be seen in Figure 22. A 1x1m test pit was dug inside and a further pit on the outside of the eastern bank. A further pit was placed further down the hill where a strong magnetic response was encountered in the magnetic survey and another pit was placed to the south of the enclosure. A larger trench measuring 4x1m was placed across the western bank in order to help understand the feature.

2.4 Sampling Interval, Resolution and Depth

2.4.1 Sampling Interval – Earth Resistance

Sample readings were recorded at 1m centres along a standard 1m traverse in a zigzag fashion across a 20m grid. This methodology provides up to 400 samples across the grid. This was to facilitate speed and ease of operation over a more detailed sampling regime.

2.4.2 Resolution and Depth – Earth Resistance

The twin probe spacing of 0.5m will provide a good depth resolution of up to 0.75m. A greater probe separation using an extended 'Wenner' array can provide an increased depth of seeing. The results can prove complicated due to complex 'peaking', caused by the close proximity of the point sampling across the survey. In this case the depth requirement was not needed at the expense of the slowing the survey down. A series of experimental tests using the ‘Wenner’ array was carried out across part of the survey area and can be explored in detail in Appendix 4.

2.4.3 Sampling Interval – Gradiometer

The data was collected at 0.25cm centres along a 1m traverse in a zigzag fashion. The sensors will collect 1600 readings on a standard 20x20 metre grid.

2.4.4 Depth and Resolution – Gradiometer

The Bartington Grad 601 has an average depth detection of around 0.5 and 1m. If the anomaly is strongly magnetic and deeply buried, the depth of detection can be increased. Using a 0.25x1m collection strategy provides an optimum balance over time and resolution.

2.5 Processing and Presentation of Results

2.5.1 Processing – Earth Resistance 216M

The processing of the data sets was initially carried out using dedicated templates within Microsoft Excel in order put the data into grid order. This is followed by correcting any basic errors in the data sets and then exporting the data into .XYZ format for further manipulation by dedicated software. The data was then entered into another geophysical software package called ‘Snuffler’ for further data processing and final visualisation. The initial data is arranged into composite sets for viewing and then processed using algorithms. Basic data processing was carried out using the ‘despike’ operative in order to remove any high resistance data spikes, such as large stones in the ground. Then a standard ‘high pass’ filter was applied to the data in order to reduce the effects of the background geology (reduce the large variations caused by geology) and enhance any archaeological features. Finally the data is interpolated or smoothed to make it more readily comprehensible.

2.5.2 Processing – Earth Resistance TR/CIA meter

The data was downloaded into ‘Snuffler’ for grid ordering, data processing and final visualisation. Again, the data is arranged into composite sets for viewing and processed using algorithms. Basic data processing was carried out using the ‘despike’ operative. Then a standard ‘high pass’ filter was applied to the data and finally the data was interpolated.

2.5.3 Processing – Gradiometer

The collected data was downloaded from the gradiometer to a PC using an RS-232 interface and the data was ordered into grids and processed using the 'Surfer' programme package (Golden Software Inc.). The software can use powerful mathematics to order or interpolate data into a more pleasing way.

3 Results

3.1 Introduction

3.1.2 The field walking produced no positive finds of antiquity. There were some fragments of late post medieval pottery (19th century) found on the main path leading towards the bottom of the hill. This was probably pottery fragments used to help construct the main path and does not add to the archaeological record of the hill itself.

3.1.3 The results of the metal detecting survey can be seen in figure 14. All of the finds are considered modern. The coin was a post decimalisation 10 pence piece from 1973. The clasp is a modern alloy and looks like it would have come from a modern rucksack. The metal fragment is a non-descript modern alloy and the horse shoe is a modern pony shoe. Considering horses are sometimes kept on the hill side it is not surprising such metal debris is lost on the hill.

3.1.4 The findings of the kite aerial photographic surveys can be seen in figure 15 are discussed below. A series of computer rendered models were produced by entering a number of the aerial images into photogrammetric software, Agisoft's Photoscan. The data can be exported into other rendering software such as Meshlab. Rendering software can have the ability to cast artificial light across a model. This can help to examine features from different perspectives in varied light. The final models can be seen in figures 26-29.

3.1.5 The topographic survey was carried out over and around the feature and the results can be seen in figure 25.

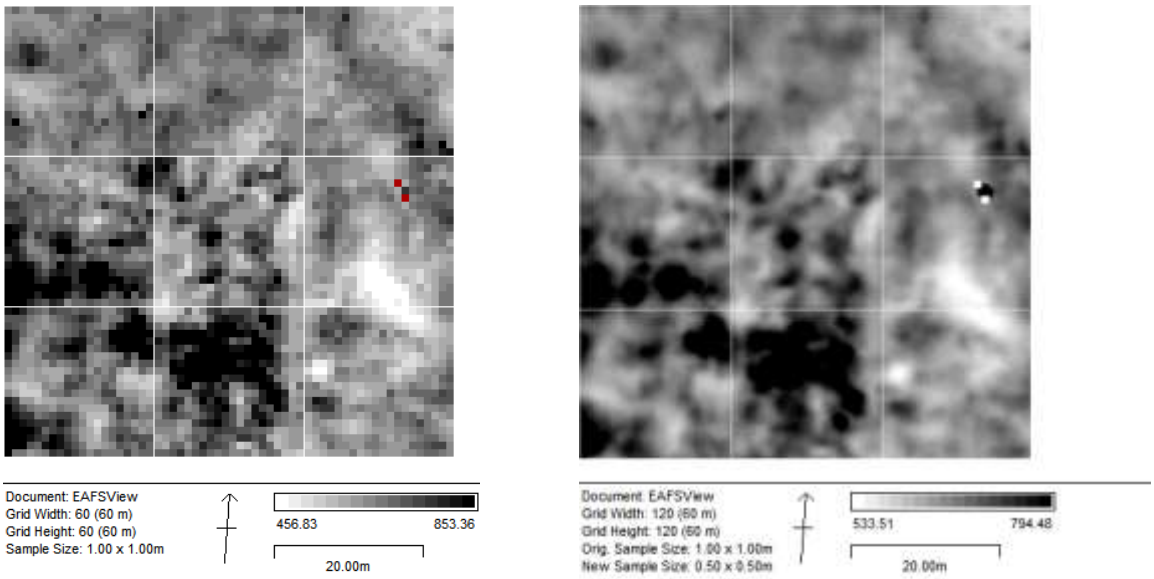
3.1.6 The geophysical results will focus on the 216M earth resistance data set (figures 17-24).

3.1.7 TR/CIA Earth Resistance Data

Both the raw (unprocessed) and the final processed data is shown together for comparison. The lowest reading recorded was 456.83 Ohms and the highest was 853.36 Ohms. The highest readings are therefore shown in the image as black features of high resistance and white as low resistance, with levels of grey in between.

Figure 1 Showing the Raw and Processed Data

Raw Data | Processed Data

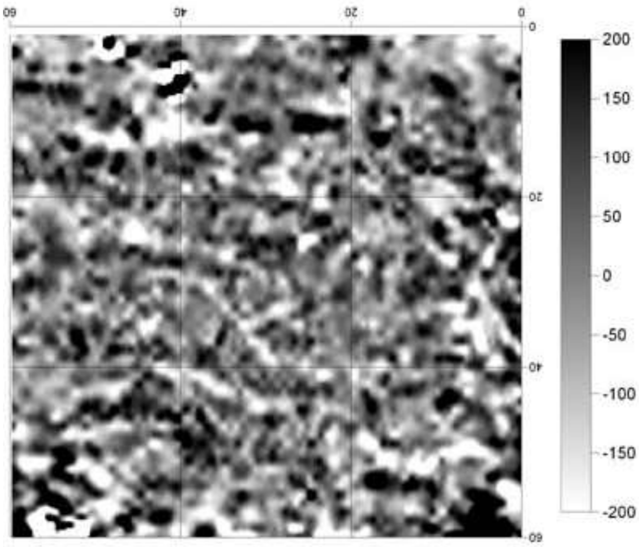


3.1.8 Gradiometer Data

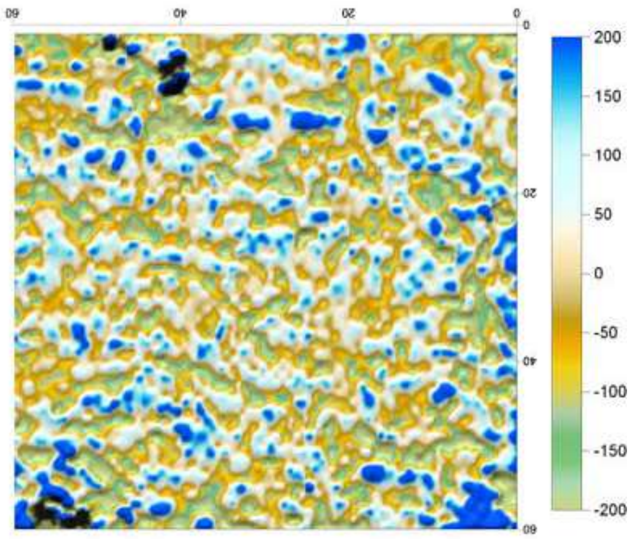
The unprocessed data is presented below. The highest magnetic readings are therefore shown in the image as black features and inversely white as low magnetic anomalies, with levels in between.

Figure 2 Showing the Gradiometer Data

Grey Scale Data



Colour Data Set



3.1.9 216M Earth Resistance Data

The processed data is shown below. The lowest reading recorded was 71.82 Ohms. The highest reading was 202.27 and the average reading was 106.45 Ohms. The highest readings are therefore shown in the image as black features of high resistance and white as low resistance, with levels of grey in between.

Figure 3 Showing the Raw Earth Resistance Data

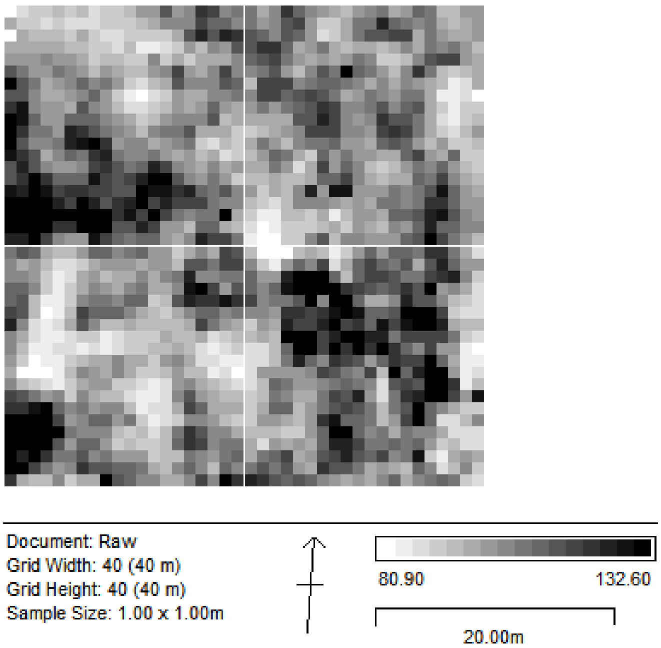


Figure 4 Showing the Processed Earth Resistance Data

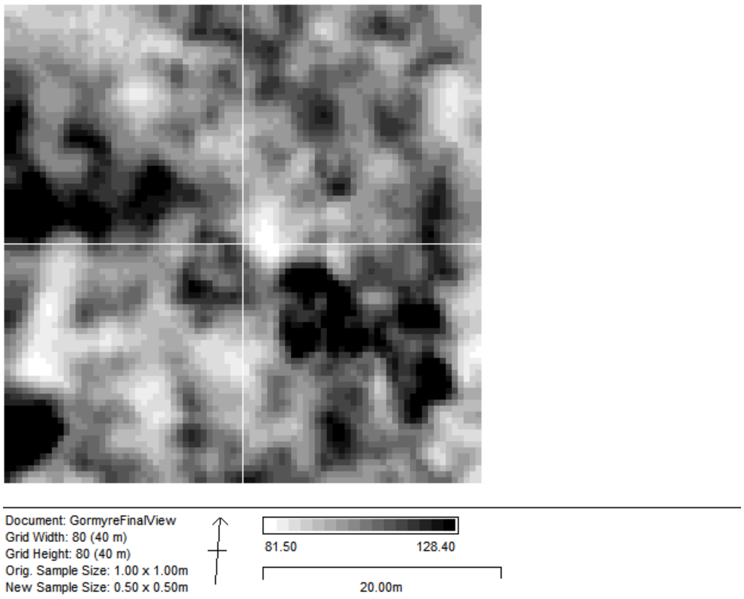
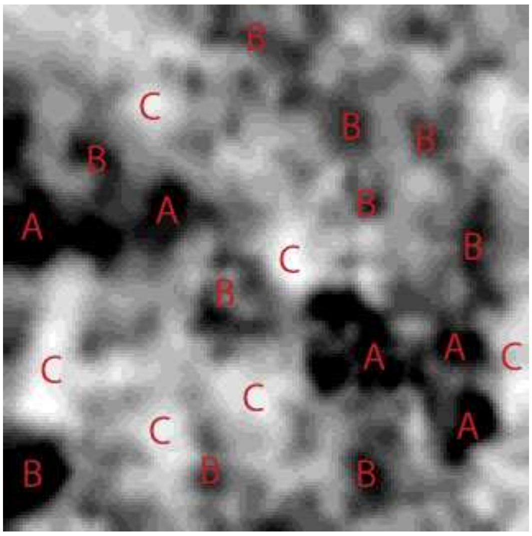


Figure 5 Showing the Processed Earth Resistance Data with Interpretive Labelling



There are numerous areas of irregular higher resistance (labelled A). This forms a linear trend running east to west across the immediate area. There is a similar trend around this formed of discreet higher resistance (labelled B) anomalies. There are a number of discreet lower resistance anomalies (labelled C) in and around the areas of higher resistance.

The 216M earth resistance and interpreted results overlaid onto the survey area can be seen in figures 17 to 20.

An alternative interpretation of the earth resistance results can be seen in figure 21, where the blue outlines simply follow the natural features that can be seen above ground and in the aerial images.

3.2.0 Trial Excavation

All the test pits and single trench were excavated by context down to the natural bedrock. An example of a typical test pit can be seen below in figure 6.

Figure 6 Showing a Drawn Plan View of Test Pit 2.

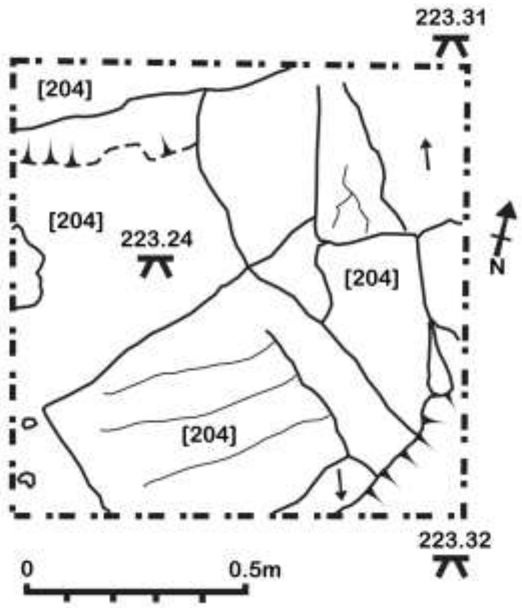
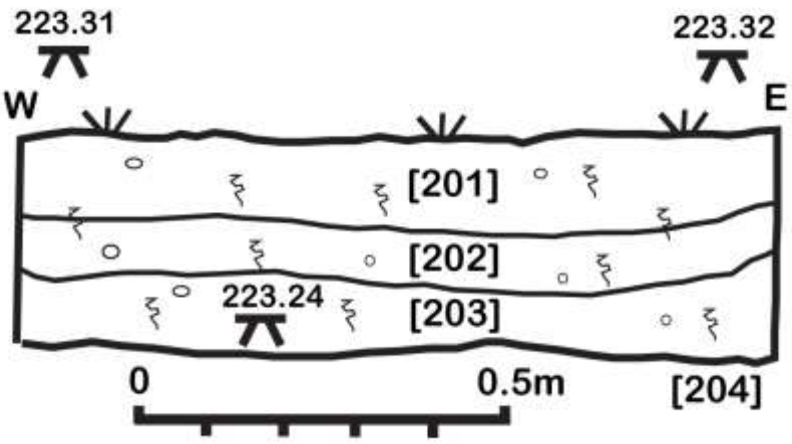


Figure 7 Showing a South Facing Section through Test Pit 2.

Test Pit two was located on the outside of the eastern bank. It can be seen the depth of any overlying natural soils measures only a few centimetres in depth before reaching the natural bedrock below. There were no obvious signs of plough scaring on the bedrock or other obtrusive features. A section through test pit two can be seen in the drawing below.

Figure 8 Showing a Drawing of the South Facing Section through Test Pit 2



Despite the shallowness to the soils on the eastern side of the feature, the soil still possesses a stratigraphic matrix. We have the upper layer (labelled 201). This is comprised of earth, interwoven with grass, gorse and sphagnum moss roots, typical of a wet low land environment of this region. Below this the upper layer is a dark-brown peat layer (labelled 202). This is formed of decaying matter and is on average eight to ten centimetres in thickness. Below layer [202] is a mid-brown silty loam (labelled 203). This soil is very clean and gives the appearance of being washed through by ground water. The soil does not appear to have been heavily improved through artificial means. All layers contain sub-angular stones and bioturbation throughout. Below layer [203] is the natural bedrock. This can be seen forming pillows of igneous rock, stepping down across the landscape. Some of the upper layers of the bedrock are weathering and thus mixing into layer [203]. In all of the test pits no significant archaeological features or artefacts were identified.

Test pit three was entered in the middle of the enclosure to try and locate any features or finds. The section through the test pit can be seen below in figure 9.

Figure 9 Showing a Drawing of the North Facing Section through Test Pit 3

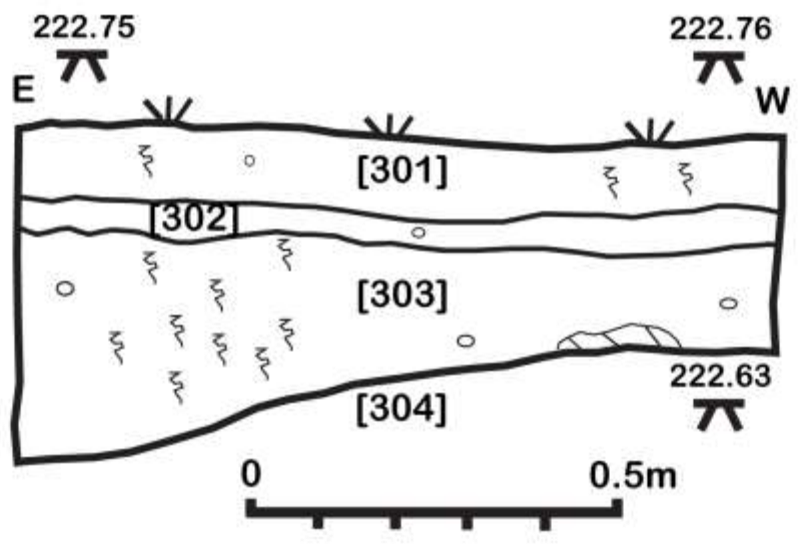


Figure 10 Showing a North Facing Section through Test Pit 3.

W E

Again we encounter the exact same matrix across the site. There are more roots on the eastern side of the test pit due to the build-up of soil material [303] following the natural geology and less on the western side. Again nothing of archaeological significance was found.

A trench [TR1] was located across the western bank of the enclosure and the section drawing can be seen below.

Figure 11 Showing a Drawing of the North Facing Section through Trench 1.

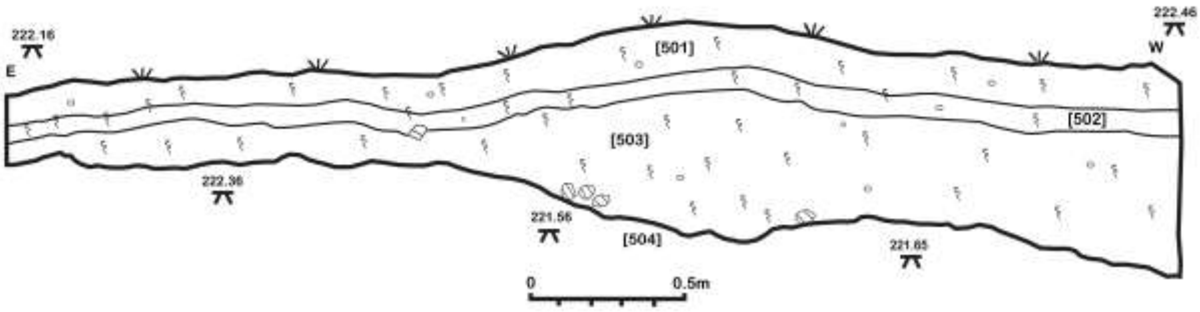


Figure 12 Showing a Photographic Plan View and North Facing Section through Trench 1.

E W

The same matrix as the test pits can also be found in trench 1 and the main western bank can be seen roughly where the label [501] is located on the drawing. There are no clear indications to suggest that the bank was cut or constructed in any way. Again, there was an increase of bioturbation around the bank area, with occasional sub-rounded stones scattered through all soil levels. The soil level became much deeper moving towards the west beyond the bank area. Again, this was following the natural bedrock as it stepped down across the hill. No significant archaeological features or artefacts were encountered in the trench.

4 Interpretation

4.1.1 Discussion

Both sets of earth resistance data provide inconclusive results. The earth resistance survey revealed very little and was dominated by the surface scrub and geology. The survey did detect something of the enclosure area (structure 1) on the western and eastern side, but discerning anything within the confines is difficult. The magnetic survey also proved inconclusive and was overwhelmed by the igneous bedrock. There were a number of strong bipolar responses further down the field that were of interest. These anomalies were examined with the metal detector and a test hole was dug into one of the features (TP4), but nothing of significance was located. It was concluded that the anomalies may have been caused by the eroded geology or localised iron that was not found.

The trial excavation proved inconclusive in locating any archaeology or finds. The formation of the peat layer is important. It is suggested that peat generally forms around a millimetre per year (Keddy 2010, 497). The formation rate is obviously dependent on many other factors that cannot be taken into account, but gives us a general idea of when the land may have fallen out of use. This information suggests that the peat layer has formed, on average, for nearly 100 years. This does not support the cartographic evidence of a visible surface feature and suggests that the peat layer formed much more slowly. The cessation of cultivation is closely followed by the onset of peat growth, sealing the landscape below. The soil below the peat layer is free draining and could be seen as agricultural in nature, but it has not been cultivated significantly. There is no remaining evidence for the soils being constantly improved with organic matter from manuring or burning. The banks themselves do not contain any structural elements such as placed stones to support a stone built bank. There is no indication of cut features, such as post holes, ditches or turves to suggest the bank was artificially constructed. This would suggest that either the excavation did not reveal such features or was created by another process.

It could be suggested that the eastern and western banks are the result of plough action. They are the rigs formed from the plough turning the earth over forming a bank. They appear more substantial due to flora taking full advantage of the deeper soils where the geology naturally falls away across the hillside. It is proposed that the farmer of the land ploughed with a traditional ploughshare and mould board. When the plough reached the top of the hill, it was removed to come back down the same strip (strip cultivation), hence there are no obvious 'S' turns in the headland or obvious furrows. These may have simply been worn away over time and left no trace today. The raised banks would have provided excellent drainage down the hill. It was probably realised early on that the ground was insufficient to cultivate crops. The land was left fallow and the continuing wet conditions created a semi-bog environment that can be seen today. The lower soils appear to have been thoroughly washed through by the slope of the geology with no finds what so ever. This means that if there are any finds, they are probably much further down the hill and completely out of context.

The kite photographic image (figure 30) taken during the winter months with a fresh covering of snow, appears to show a clear rectilinear enclosure (structure 1). If we examine the image taken in the summer months (figure 31), there is a distinct lack of a clear enclosure and appear to have raised banks on the eastern and western sides only. There is no clear indication to the extents of the northern and southern banks.

The topographic survey results as seen in figure 25 show that the east and west boundaries of the enclosure were clearly recorded. The southern and northern extents proved more difficult. On the ground the rear of enclosure was difficult to locate, if non-existent. The survey did not reveal any marked banking and the edge of the enclosure just rapidly falls away at an angle following the natural slope of the hill. The northern bank appears to be formed from the natural ridge of years of foot traffic cutting a path to the front (the lower dotted red path in figure 24) with the natural geology falling away, forming an escarpment around structure 1 (D and G in figure 24).

Some of the imaging evidence suggests that structure 1 is possibly sitting on top of earlier plough ridges. The rendered models of the hillside shown in figures 26-29, clearly show plough lines (E in figure 24) under and extending beyond the enclosure and running north down the hill slope. This would suggest that this does not mean an enclosure did not exist above ground in the form of simple turf. If the turf enclosure did exist, then the following hypotheses could be suggested;

1) The features are part of a rig system. The peat layer has built up slowly due to varied environmental conditions and being left fallow. The turf bank was built on top of and in the opposite direction to the rigs running down the hill. This will form a simple enclosure to grow a particular crop and will aid drainage due to the nature of the slope.

2) The enclosure could have been used in a farming technique called ‘Tathing’. This is where cattle are kept in a turfed bank enclosure for a limited period of time. The cattle are milked in the enclosure daily, with the resulting manure spread around in the enclosures soils. When the soils have been cultivated sufficiently, the cows are moved onto another area (Mackenzie 1995, 154).

3) The turfed walled enclosure (built higher with stone) was used temporarily to hold horses when they were used to carry building materials from the numerous quarry areas around the landscape.

It is suggested that Gormyre hill has been ploughed in relatively recent history. The field system was probably used for only a short period of time and abandoned. The field quickly reverted back to its blanket peat environment sealing the older soils below. The surface water running naturally down the slope has found natural channels alongside the rigs leaving them higher in the landscape. Overtime animals and humans have walked around the raised feature (F in figure 24) helping to form the structure as we see today.

In conclusion, it can be said that Gormyre hill enclosure is not of Roman origin and is part of a much later agricultural landscape.

5 Recommendations

5.1.1 It is hoped a further excavation can be carried out on a possible second enclosure, located further down the hill to the east. It is of the same nature as the main hill feature and could provide a further insight into the upper enclosure and the surrounding landscape.

6 References

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Cowan, I., Mackay, P. H. R., and Macquarrie, A. (eds) 1983.*The Knights of St John of Jerusalem*, Scottish History Society Fourth Series Volume **19**, 3

Keddy, P.A. 2010. *Wetland Ecology: Principles and Conservation* (2nd edition). Cambridge University Press, Cambridge.

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Surfer 7 – Gridding Software (www.goldensoftware.com/)

Cartographic References

http://www.bgs.ac.uk/education/geology_of_britain/home.html

7 Illustrative Figures

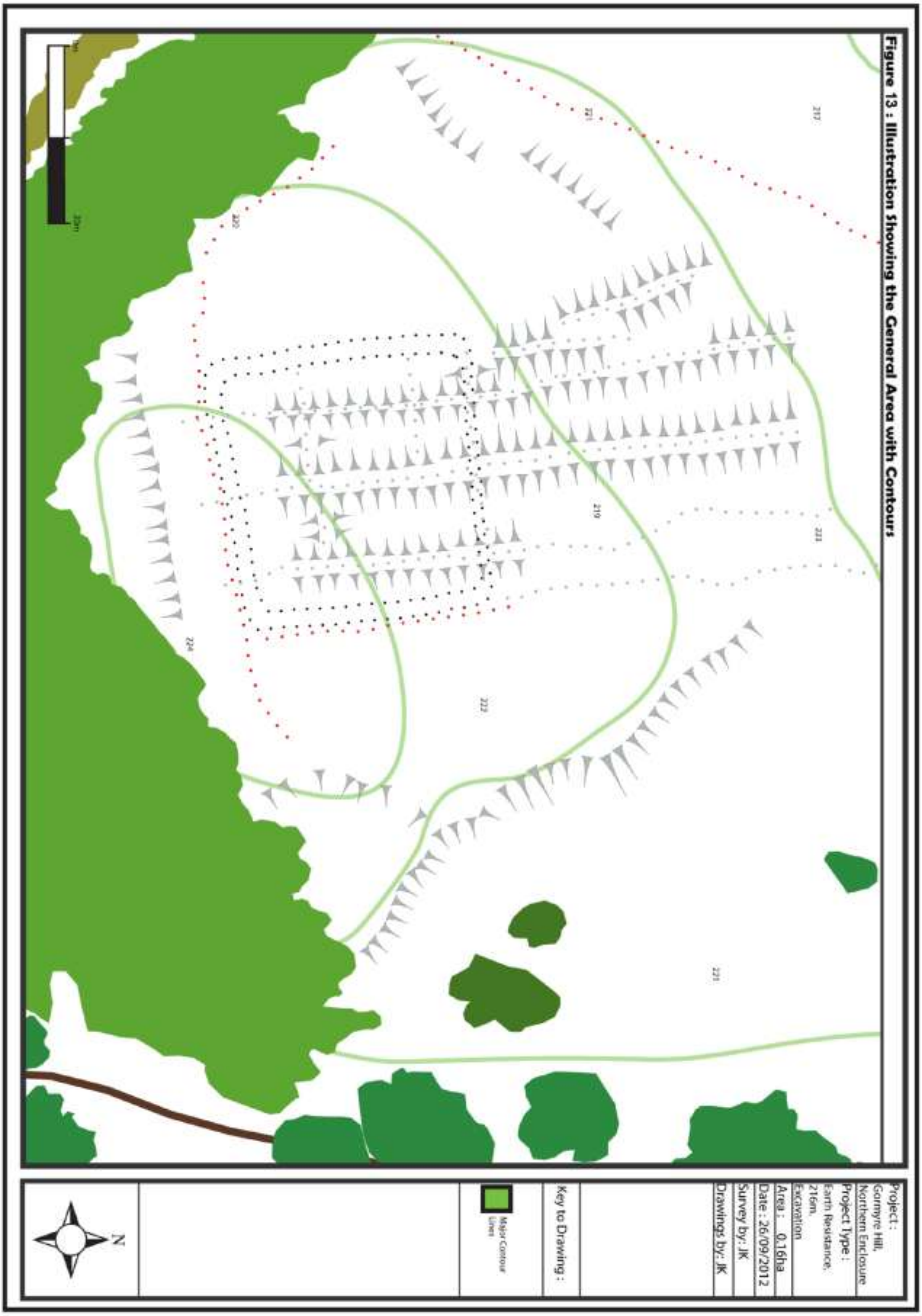


Figure 13 : Illustration Showing the General Area with Contours

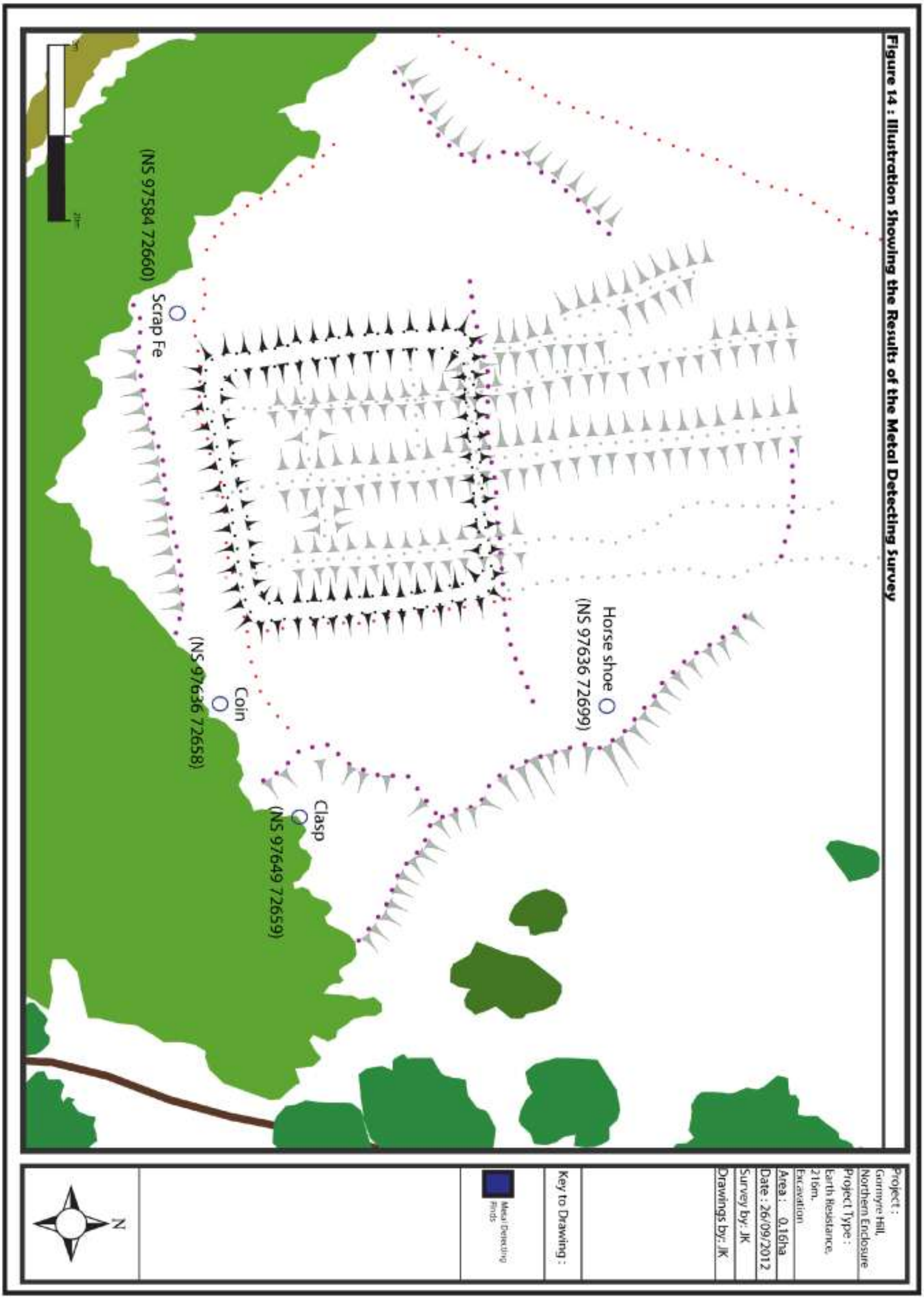


Figure 14 : Illustration Showing the Results of the Metal Detecting Survey
Horse shoe
(NS 97636 72699)
Coin
(NS 97636 72658)
Clasp
(NS 97649 72659)
Scrap Fe
(NS 97584 72660)
Project :
Gormyre Hill,
Northern Enclosure
Project Type :
Earth Resistance,
Excavation
Area : 0.16ha
Date : 26/09/2012
Survey by: JK
Drawings by: JK
Key to Drawing :
Metal Detecting Finds
N

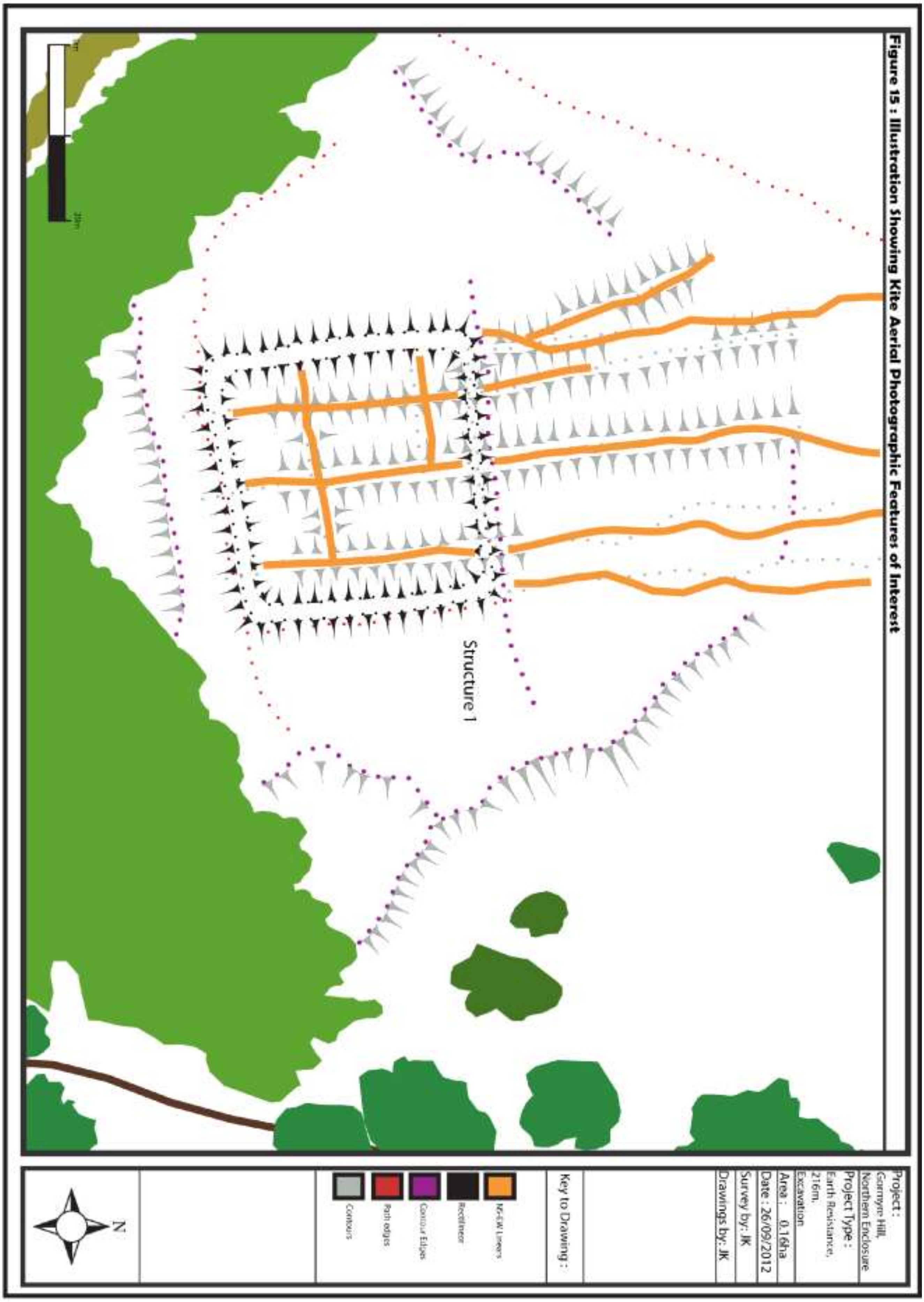


Figure 15 : Illustration Showing Kite Aerial Photographic Features of Interest
Structure 1
Project :
Gormyre Hill
Northern Enclosure
Project Type :
Earth Resistance,
216m,
Excavation
Area : 0.16ha
Date : 26/09/2012
Survey by: JK
Drawings by: JK
Key to Drawing :
Rectilinear
Contour Edges
Path edges
Contours
N

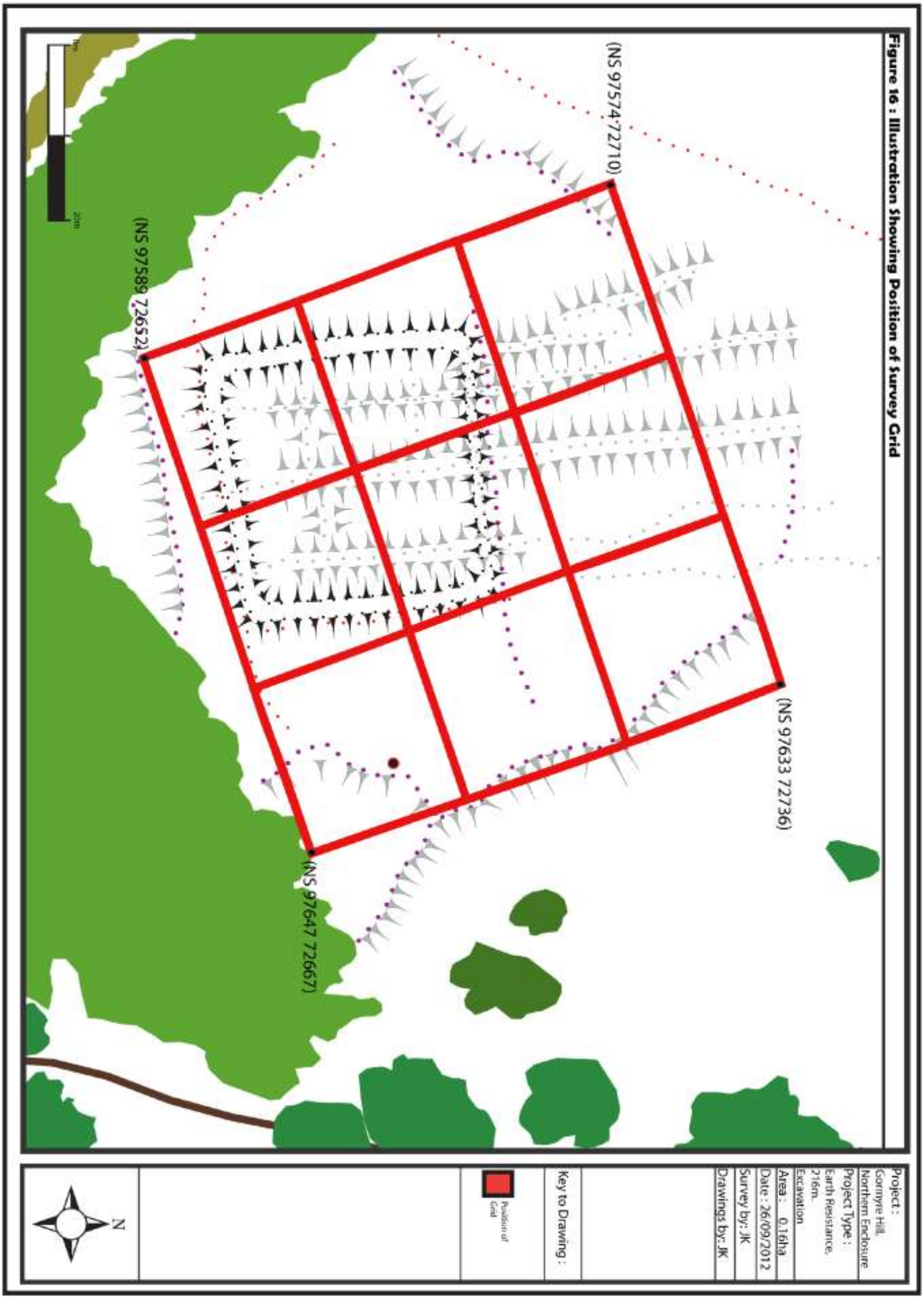


Figure 16 : Illustration Showing Position of Survey Grid

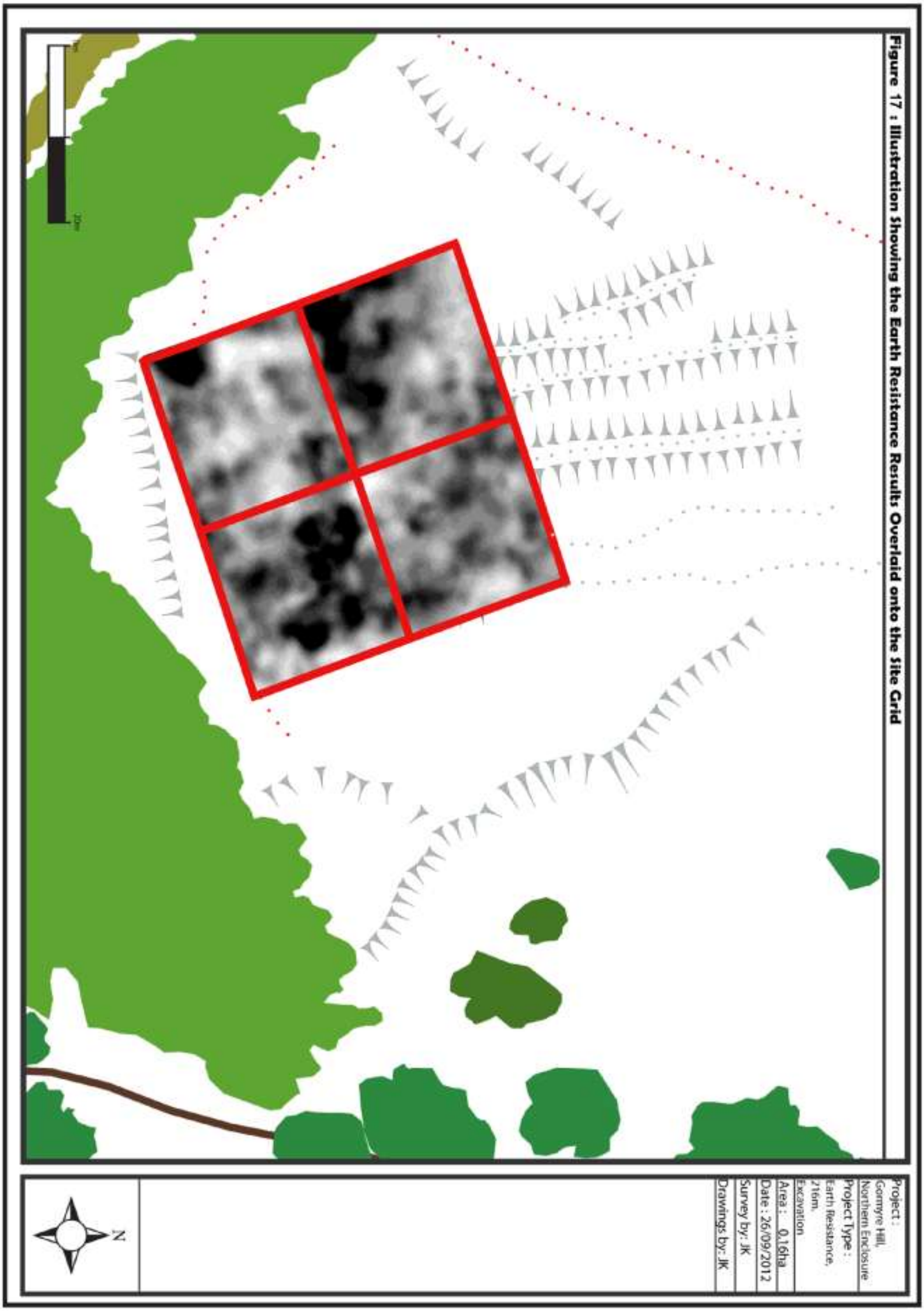


Figure 17 : Illustration Showing the Earth Resistance Results Overlaid onto the Site Grid

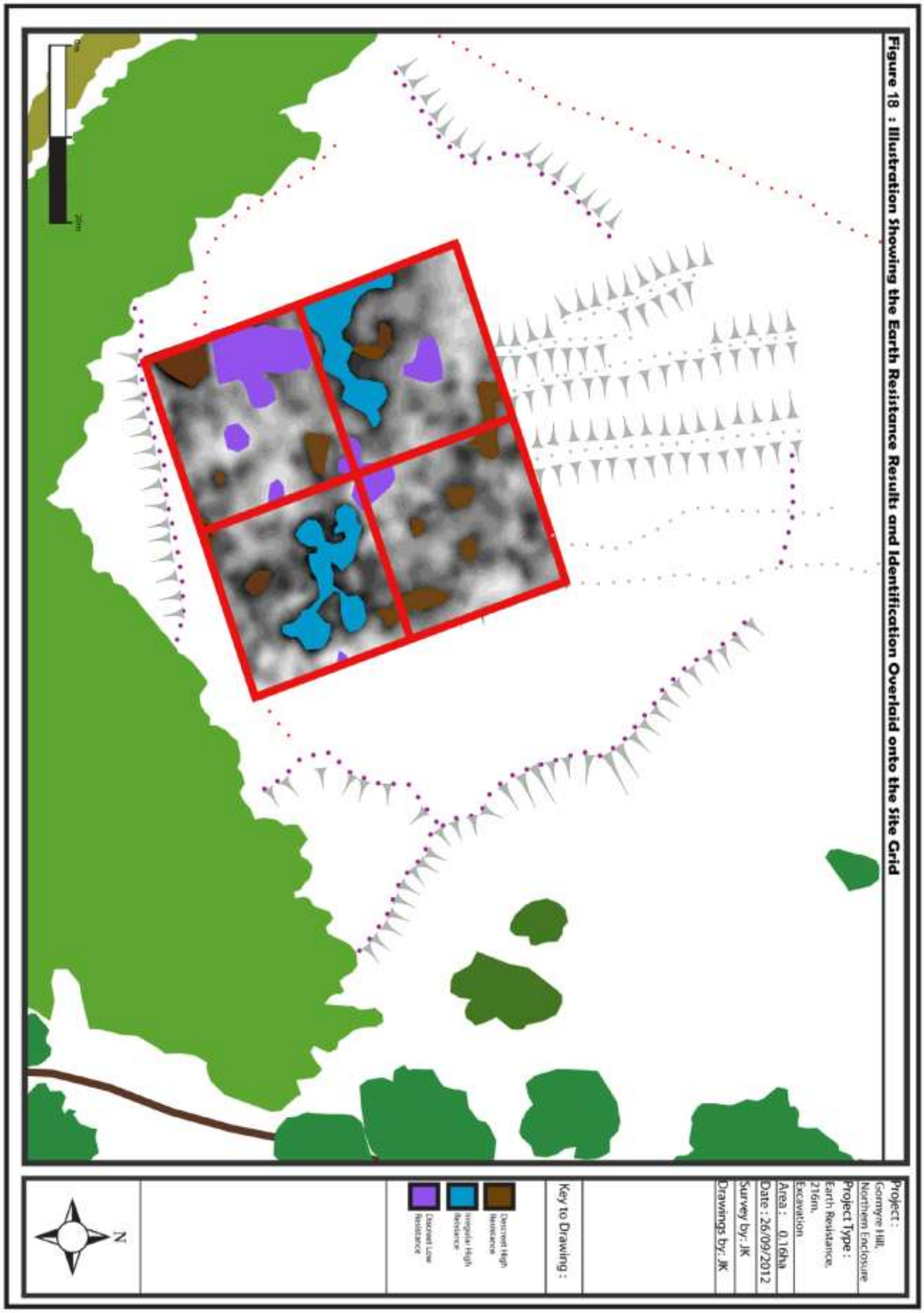


Figure 18 : Illustration Showing the Earth Resistance Results and Identification Overlaid onto the Site Grid

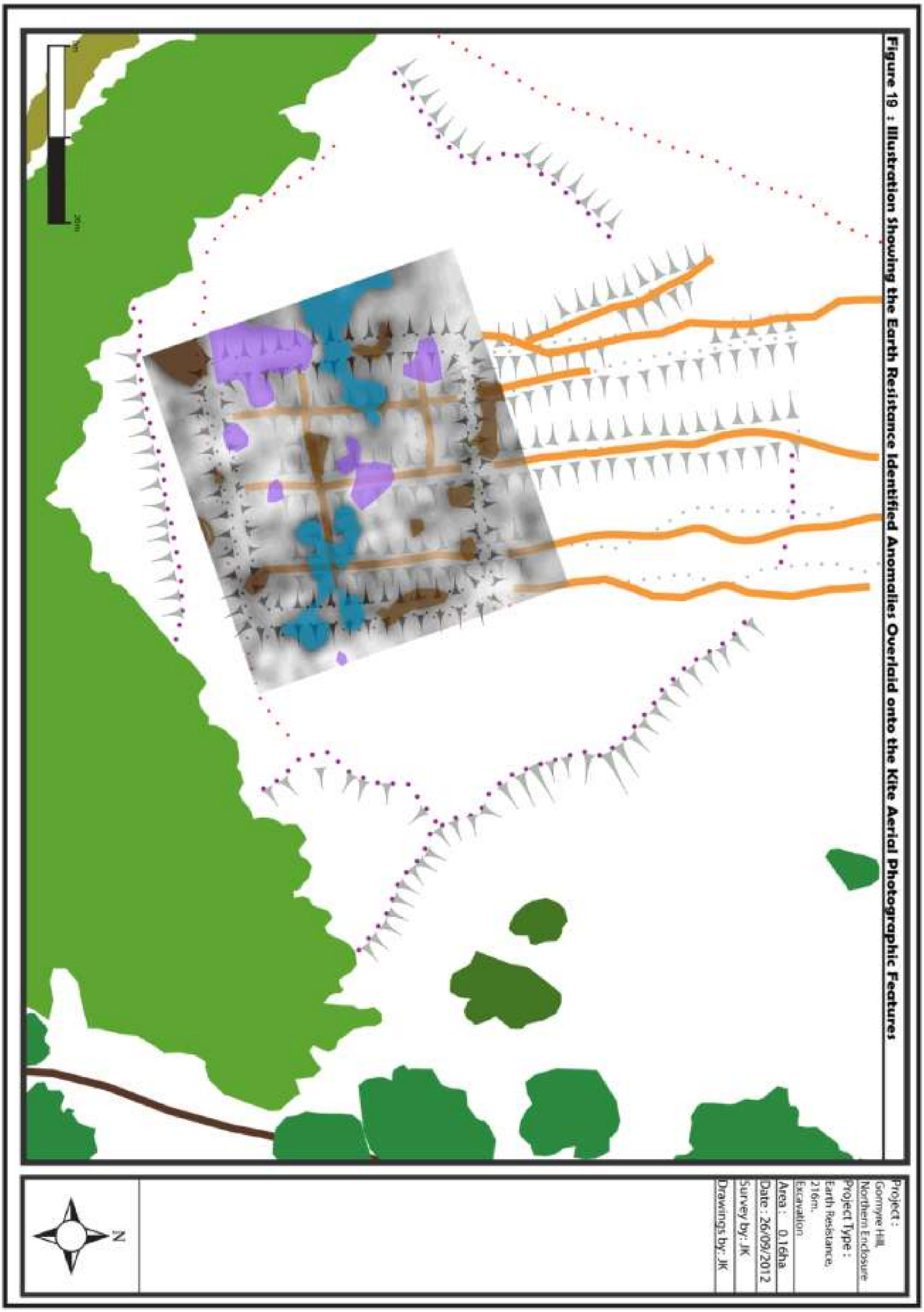


Figure 19 : Illustration Showing the Earth Resistance Identified Anomalies Overlaid onto the Kite Aerial Photographic Features

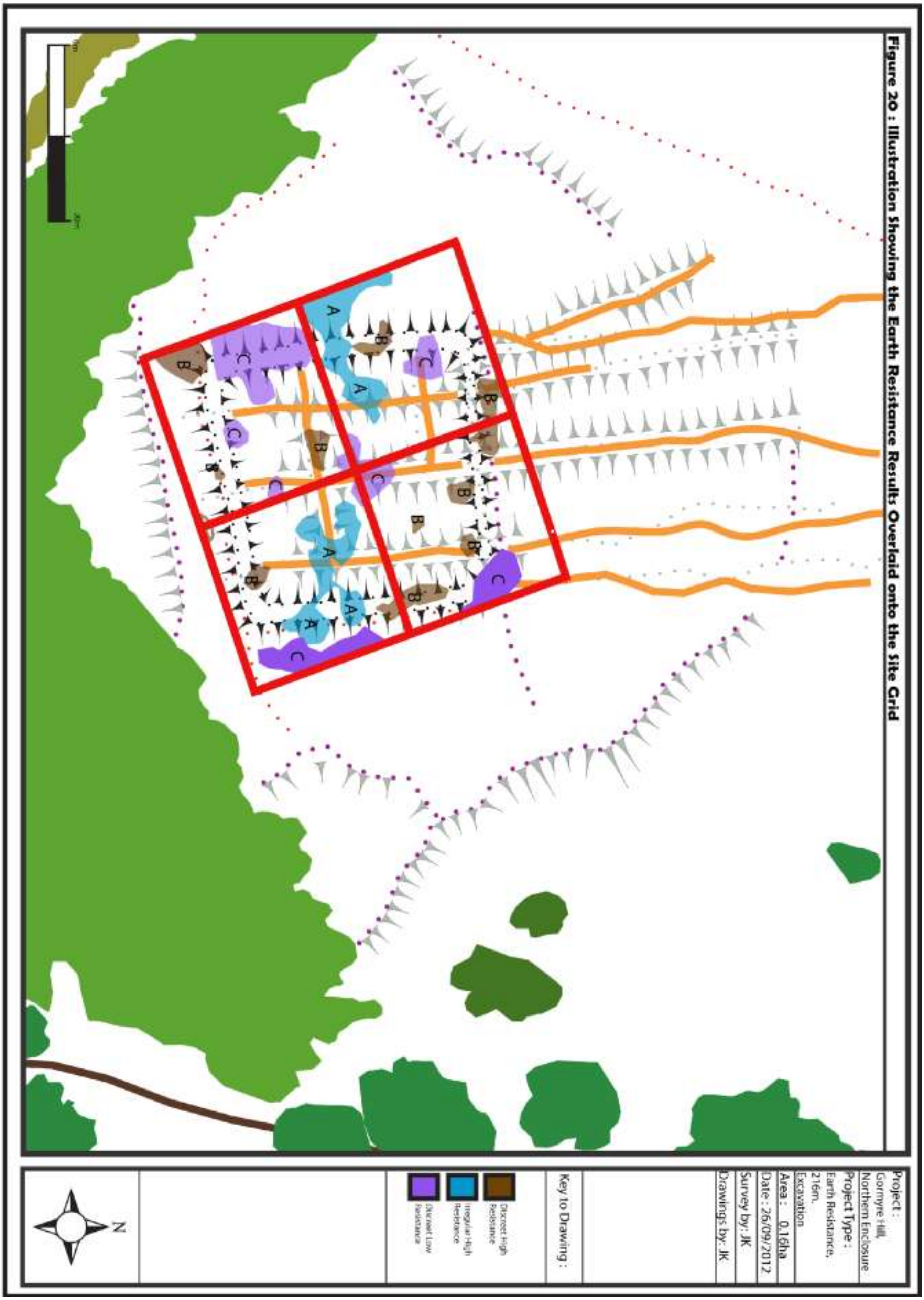


Figure 20 : Illustration Showing the Earth Resistance Results Overlaid onto the Site Grid

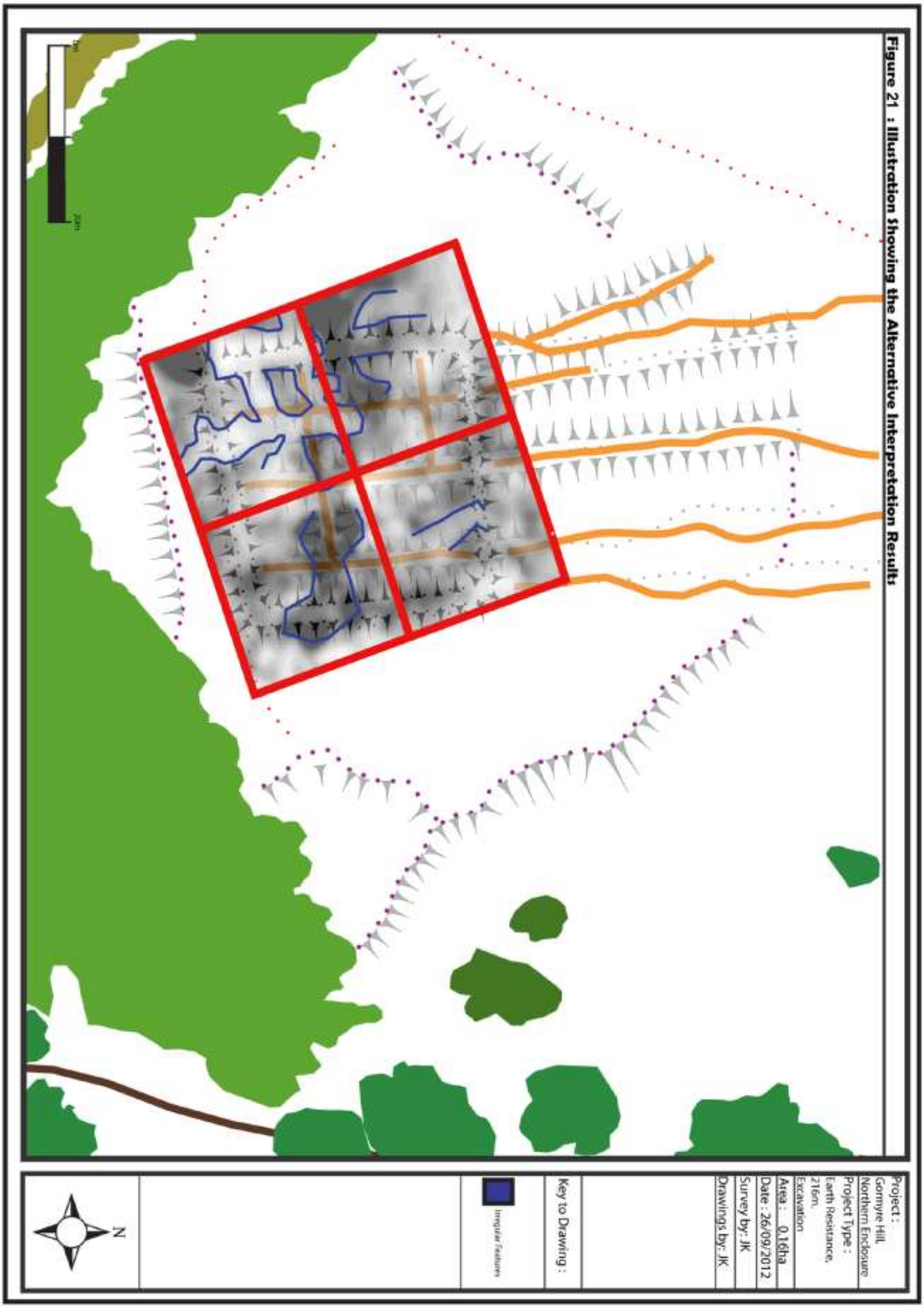


Figure 21 : Illustration Showing the Alternative Interpretation Results

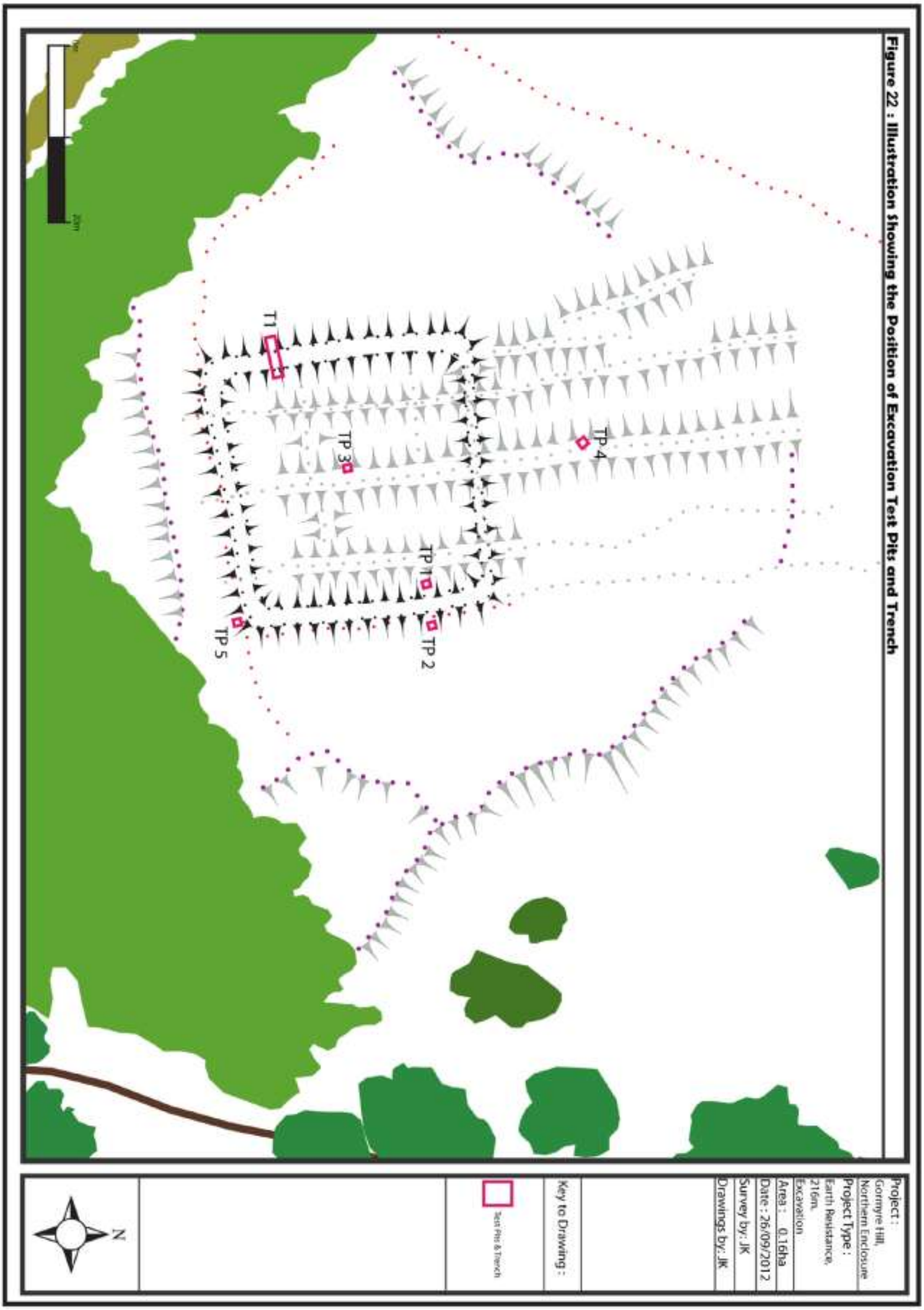


Figure 22 : Illustration Showing the Position of Excavation Test Pits and Trench

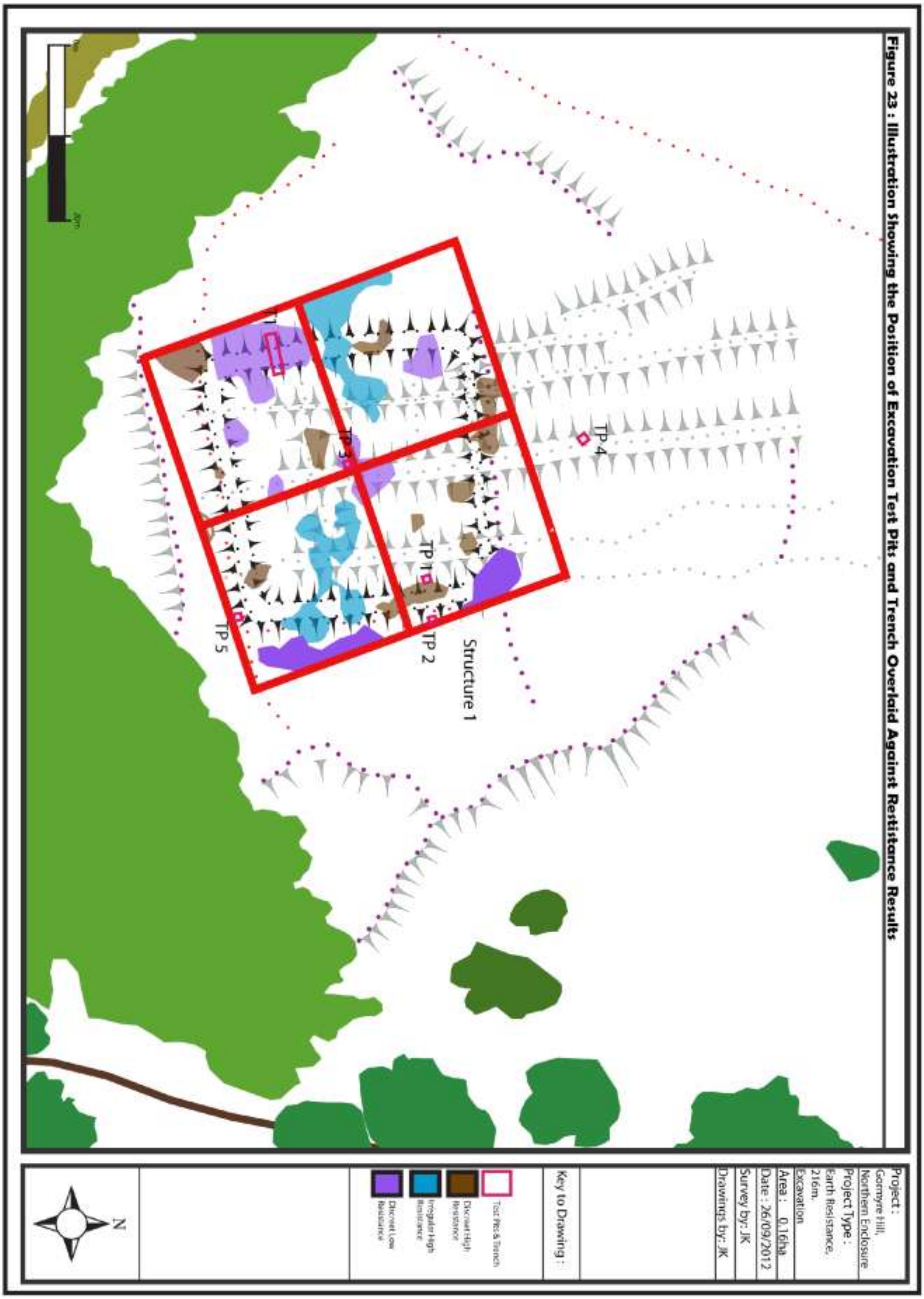


Figure 23 : Illustration Showing the Position of Excavation Test Pits and Trench Overlaid Against Restistance Results

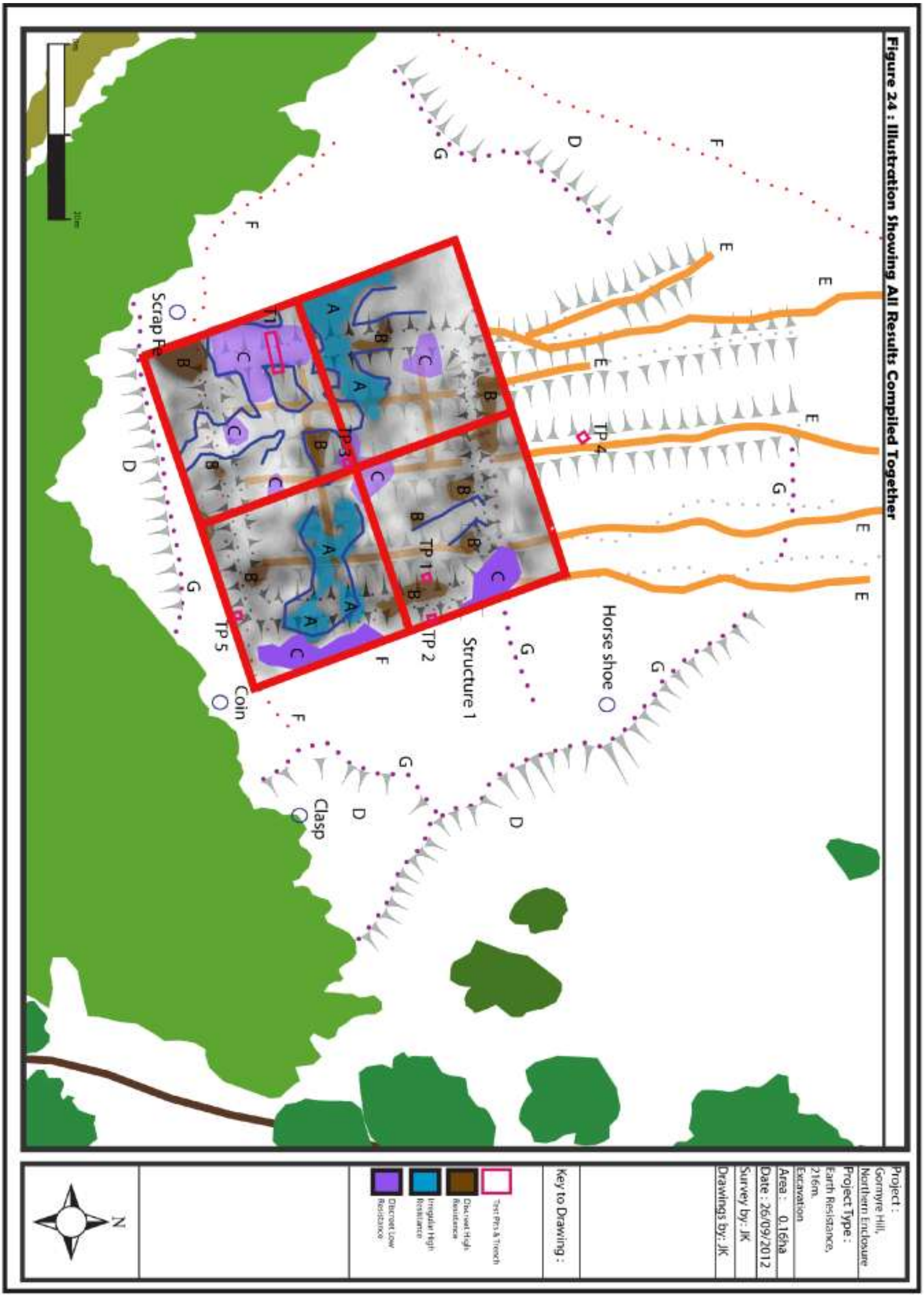


Figure 24 : Illustration Showing All Results Compiled Together

Figure 25 - Topographic Maps of the Hill and Associated Features

Contour Map of the Enclosure and Hill Side

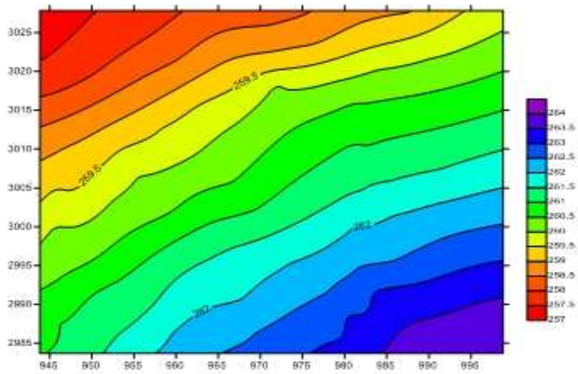
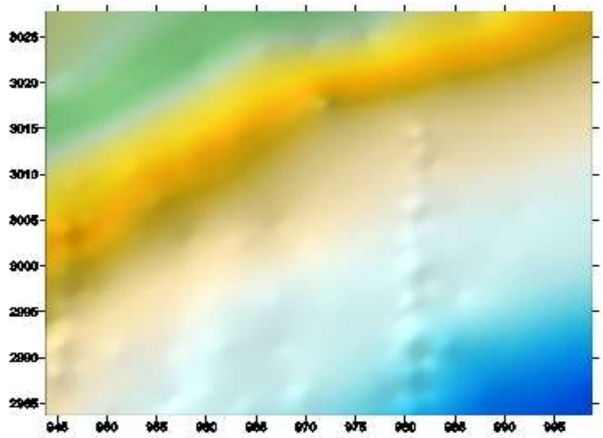


Image Map of the Enclosure & Hill Side



Digital Elevation Model of the Hill Side

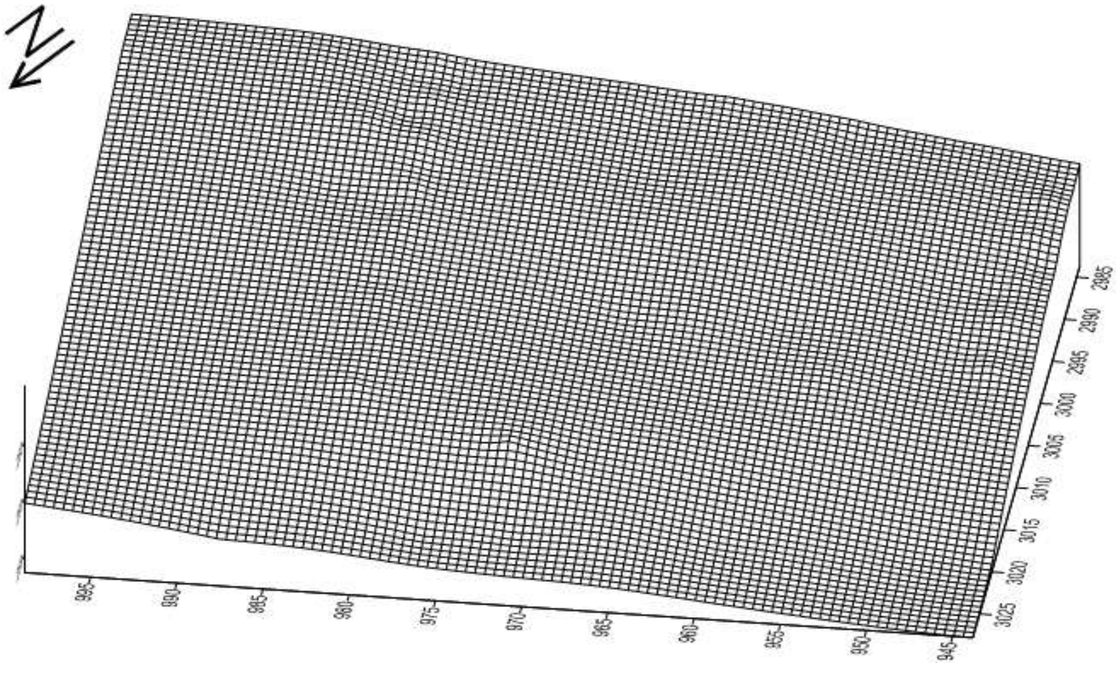


Figure 26 – A Rendered Model of Gormyre Hill Looking North with Lighting from the West

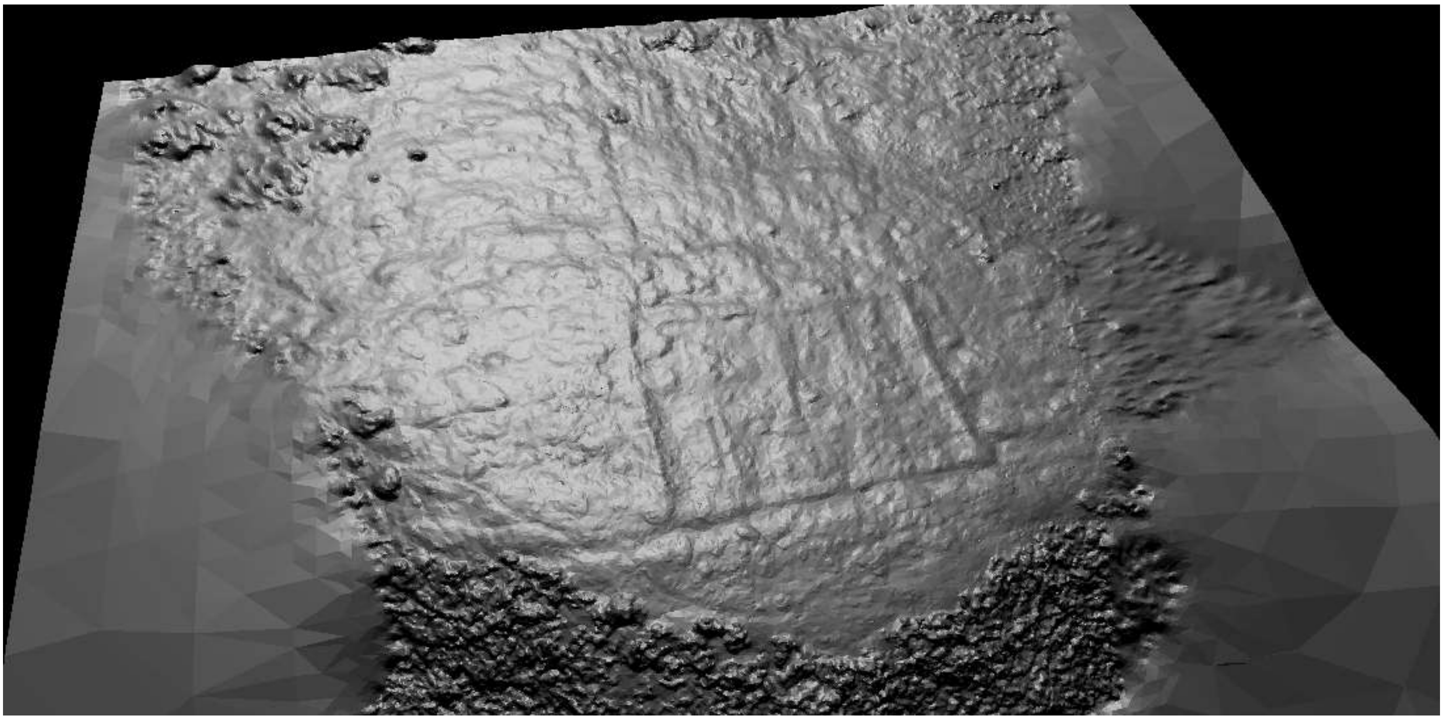


Figure 27 – A Rendered Model of Gormyre Hill looking Northwards

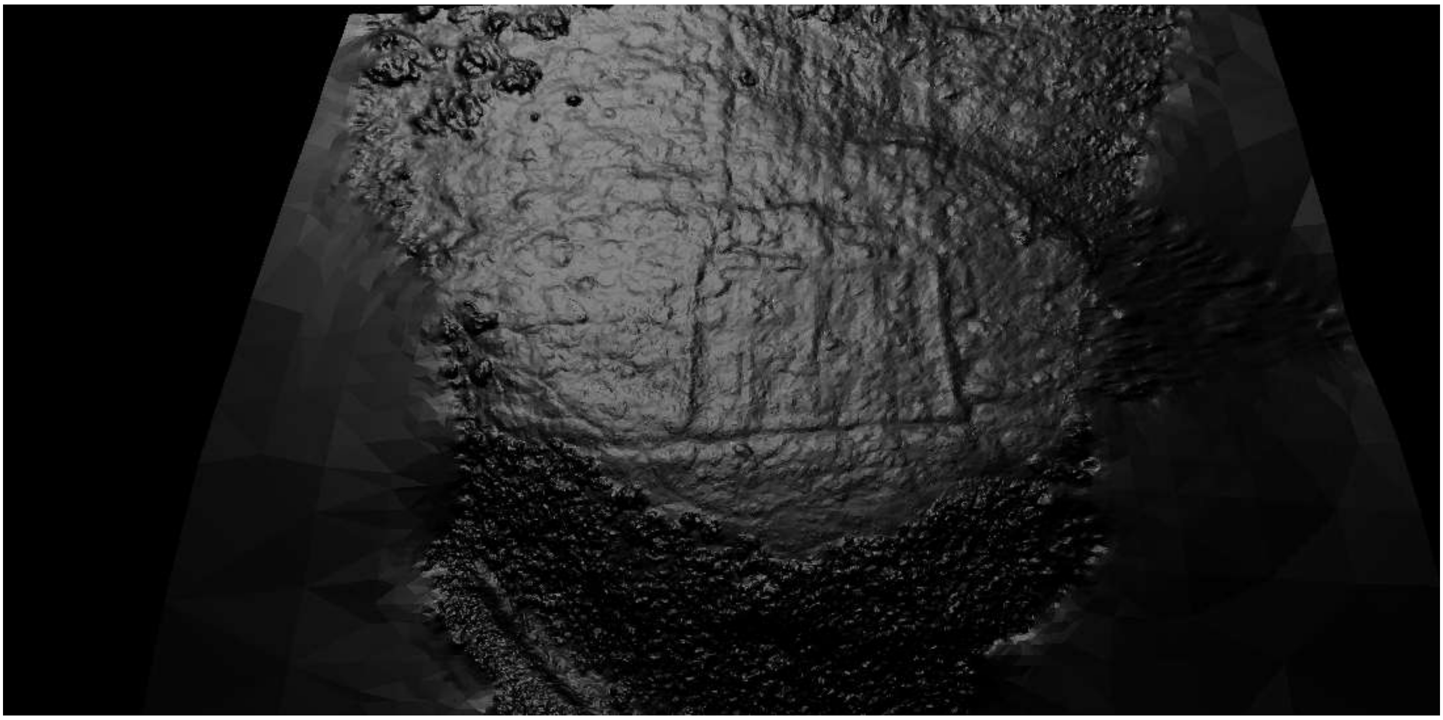


Figure 28 – A Rendered Model of Gormyre Hill with Flat Lighting

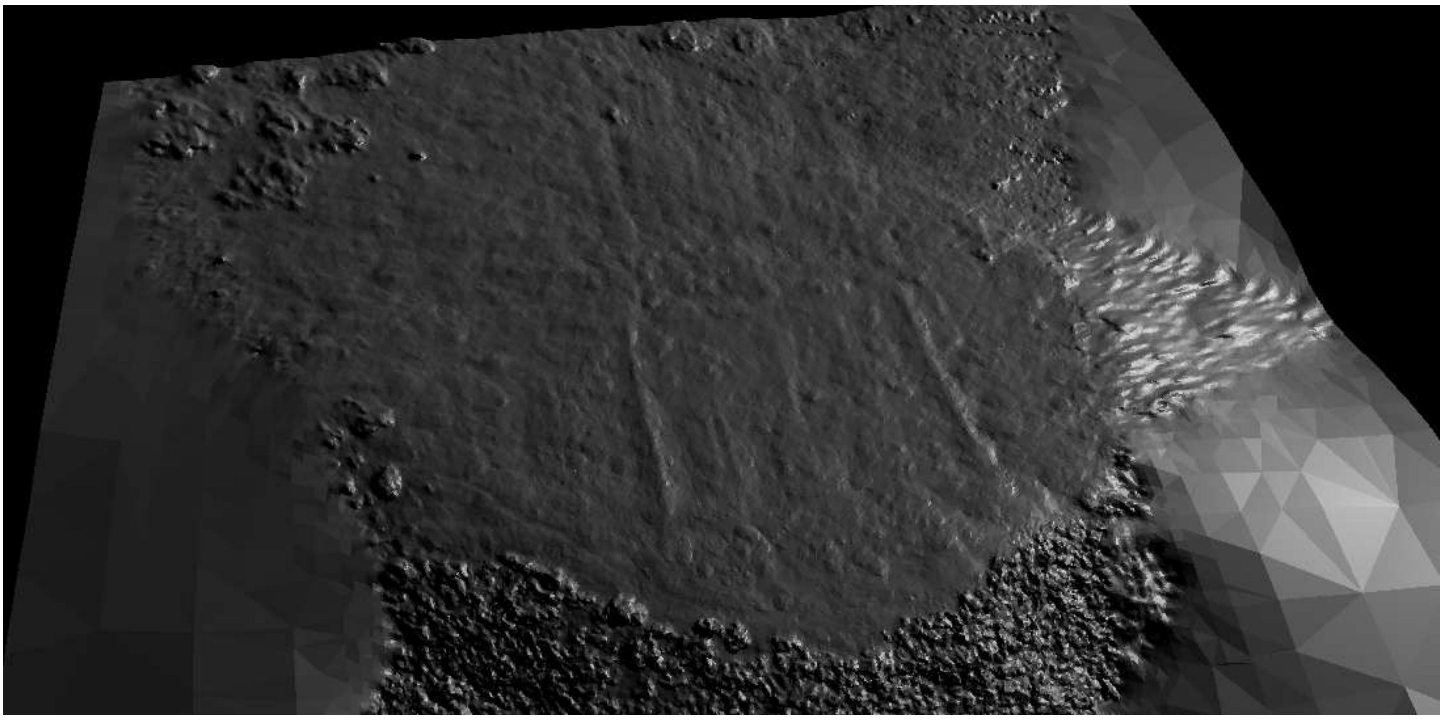
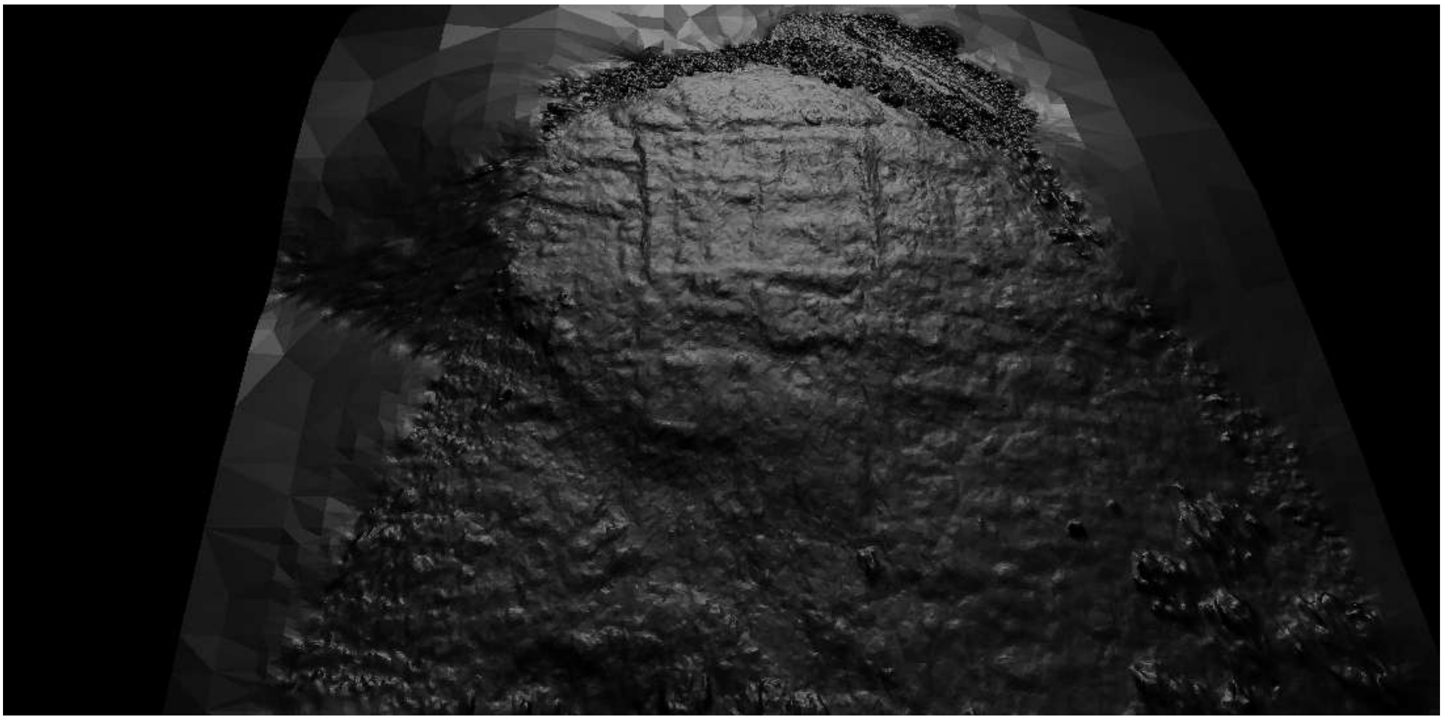


Figure 29 – A Rendered Model Looking up Gormyre Hill



8 Photographic Illustrations

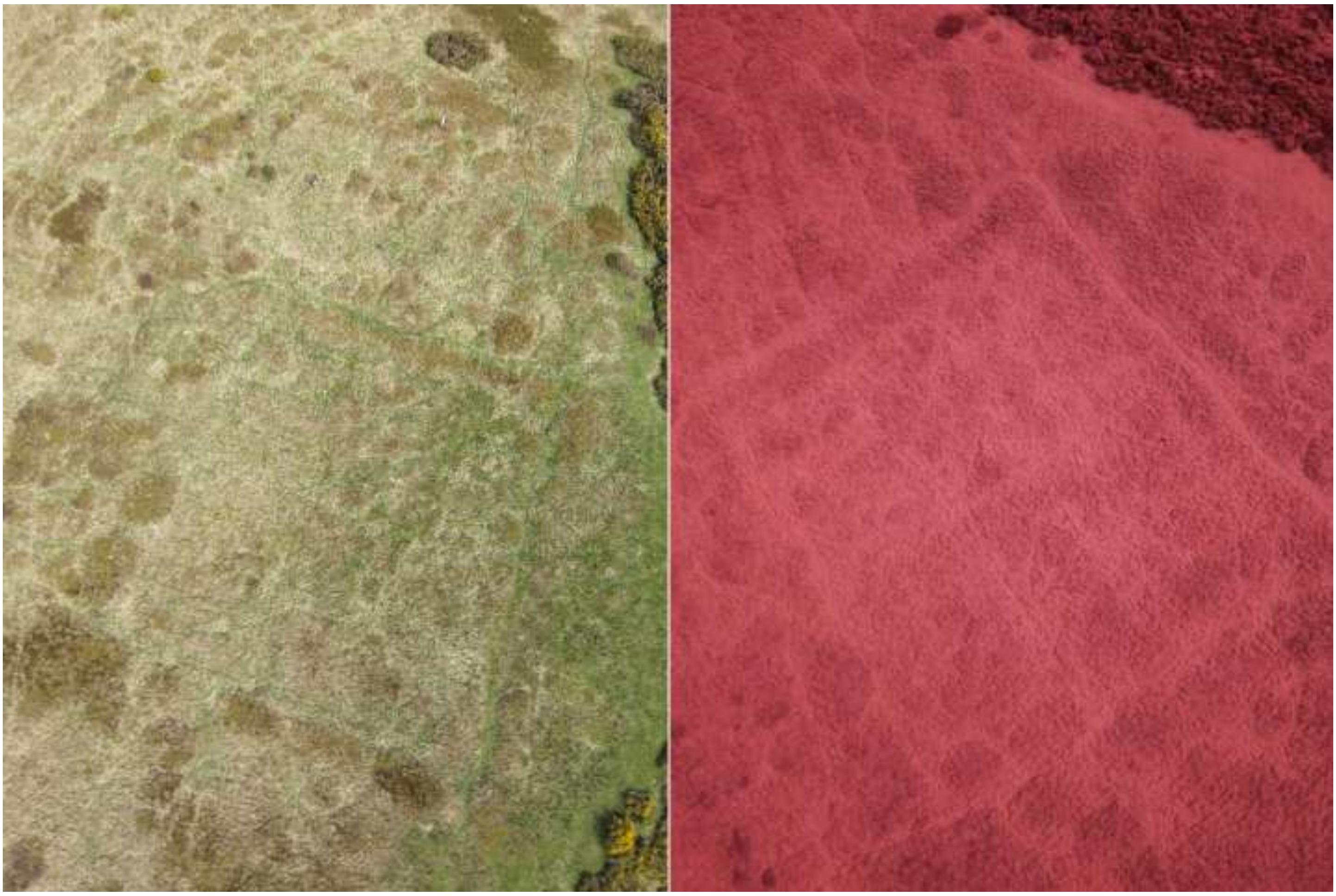
Figure 30 – Kite Aerial Photograph
View towards NNW Showing Structure 1 with a Covering of Snow

Figure 31 – Kite Aerial Photograph

View towards SW Showing Structure 1 in the Summer Months

Figure 32 – Kite Aerial Photograph

A Dual Image (Visible Spectrum and Near Infra-Red) Showing Structure 1.



A kite, with a Canon S90 and Fuji Finepix F30fd (converted for near infra-red) camera, attached to a 360 degrees rotating frame.

9 Appendix 1

Context & Test Pit/Trench Register

Test Pit or Trench:	Context No:	Context Description:	Depth (m):
TP1	101	Topsoil	0.05
TP1	102	Dark brown Peat	0.10
TP1	103	Mid brown silty loam	0.07
TP1	104	Bedrock	-
TP2	201	Topsoil	0.10
TP2	202	Dark brown Peat	0.08
TP2	203	Mid brown silty loam	0.11
TP2	204	Bedrock	-
TP3	301	Topsoil	0.10
TP3	302	Dark brown Peat	0.09
TP3	303	Mid brown silty loam	0.33
TP3	304	Bedrock	-
TP4	401	Topsoil	0.10
TP4	402	Dark brown Peat	0.07
TP4	403	Mid brown silty loam	0.08
TP4	404	Bedrock	-
T1	501	Topsoil	0.15
T1	502	Dark brown Peat	0.10
T1	503	Mid brown silty loam	0.40
T1	504	Bedrock	-
T1	601	Topsoil	0.08
TP5	602	Dark brown Peat	0.06
TP5	603	Mid brown silty loam	0.20
TP5	604	Bedrock	-

10 Appendix 2

Photographic Register

Photograph No:	Area:	Subject:	Taken From:
1	TP2	S facing section through TP2	S
2	TP2	E facing section through TP2	E
3	TP1	W facing section through TP1	W
4	TP1	N facing section through TP1	N
5	TP4	N facing section through TP4	N
6	TP4	S facing section through TP4	S
7	TP3	N facing section through TP3	N
8	TP3	W facing section through TP3	W
9	T1	W end of T1–N facing section through T1	N
10	T1	Middle of T1–N facing section through T1	N
11	T1	E end of T1–N facing section through T1	N
12	T1	General shot of section through T1	N
13	T1	Looking east down T1	W
14	T1	Looking west down T1	E
15	TP5	W facing section through TP5	W
16	TP5	N facing section through TP5	N
17	T1	General shot of T1	E
18	T1	Stitched Shot of T1	N

11 Appendix 3

Photographs

Image 1

S Facing Section through TP2

Image 2

E Facing Section through TP2

Image 3

W Facing Section through TP1

Image 4

N Facing Section through TP1

Image 5

N Facing Section through TP4

Image 6

S Facing Section through TP4

Image 7

N Facing Section through TP3

Image 8

W Facing Section through TP3

Image 9

Western End of T1 – N Facing

Image 10

Middle of T1– N Facing

Image 11

Eastern End of T1 – N Facing

Image 12

Section through bank of T1 – N Facing

Image 13

Looking East down T1

Image 14

Looking West down T1

Image 15

W Facing Section through TP5

Image 16

N Facing Section through TP5

Image 17

General Shot

Image 18

Stitched Shot of T1

12 Appendix 4

Drawing Register

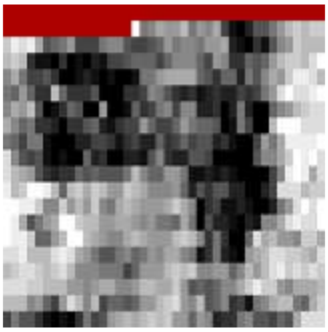
Drawing No:	Context:	Drawing Description:	Scale:
001	204	Plan View of TP2	1:10
002	201-204	S facing section through TP2	1:10
003	101-104	W facing section through TP1	1:10
004	401-404	NW facing section through TP4	1:10
005	301-304	N facing section through TP3	1:10
006	501-504	N facing section through T1	1:10
007	601-604	S facing section through TP5	1:10

13 Appendix 5

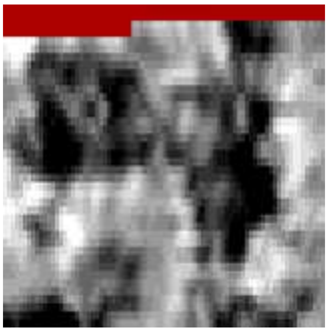
Experimental Wenner Data

It was decided to try and compare a ‘Wenner’ array against the classic twin data over a single grid on the hill side. The Wenner array is one of the classic arrays that can be used in earth resistance geophysics. There are four probes equally spaced, with the current probes on the outside and the potential probes in the middle. This array configuration is used in archaeological prospection, especially with greater spacing between each probe to enhance depth penetration. It is generally not favoured in the UK as the results can provide complex peaking when detecting features such as walls. A further problem encountered is that all four of the probes have to be in contact in the ground at the same time for a valid reading to be recorded, and this can prove problematic with rough terrain. Also the orientation of the probes is very important when using a Wenner array, whilst the twin probe configuration is not geometry dependent. The Wenner array does have the advantage of retaining all of the probes on the lower beam of the instrument, rather than having to re-position the remote probes every so many grids when the cable length runs short. This means the extra cable that is generally used in the twin probe configuration is not needed and can therefore be beneficial in smaller areas that are clear of obstacles. All four of the probes will just about fit equally on the 216M lower bar with a spacing of 30cm against standard 50cm spacing. This makes the setup comparable to the twin array. It was hoped there would be a slight increase in depth penetration with added clarity in resolution. The results of the survey are presented below, with comparisons against higher resolution in the sampling direction.

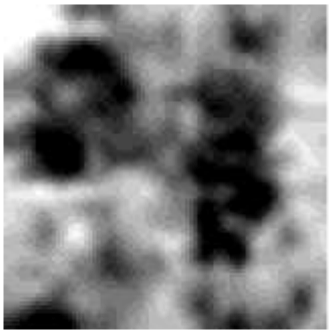
Unprocessed Wenner Data
1 x 0.5m



Processed Wenner Data
1 x 0.5m



Processed Wenner Data
1 x 1m



Unprocessed Twin Probe Data
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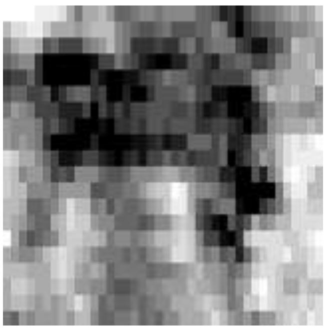
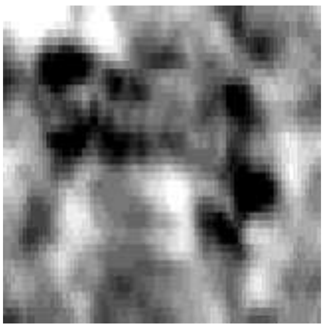
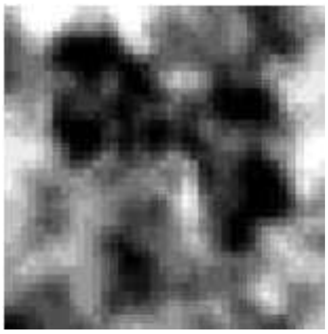


Processed Twin Probe Data
1 x 0.5m



Processed Twin Probe Data
1 x 1m



In this instance it could be said that the extra resolution in the sampling direction adds to delineating the features at the expense of distorting the data along the direction of the traverse. I think the use of both the twin and Wenner array have their merits and should be used where the survey dictates. A further future experiment will be carried out to combine horizontal and vertical Wenner data on a single grid.

West Lothian Archaeology Trust

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