A303 Sparkford to Ilchester Dualling Scheme
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9.28 Main Compound Gradiometer Survey Report

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Main Compound Gradiometer Survey Report

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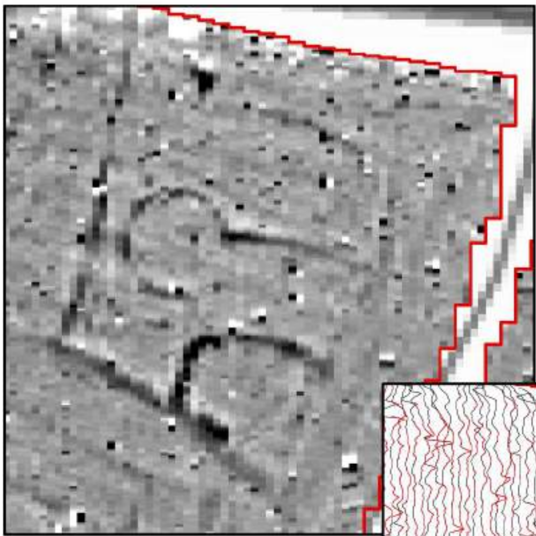
1 Introduction

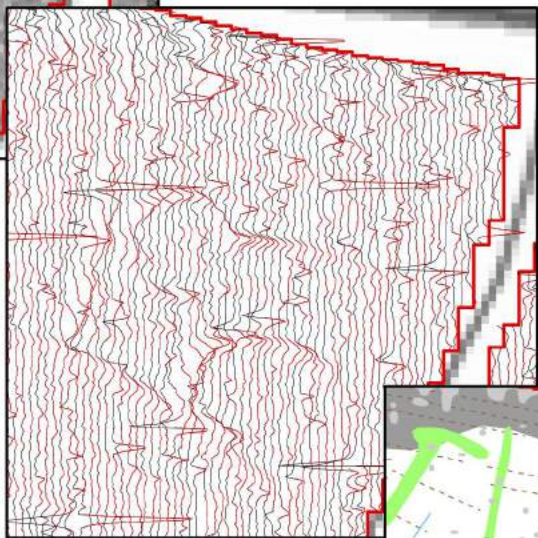
1.1.1 The Main Compound Gradiometer Survey Report is presented below and has been submitted to support the Applicant’s response to the Examining Authority’s Written Question 2.1.1 (as detailed in the Applicant’s Responses to the Examining Authority’s Second Round of Written Questions (REP5-025)).

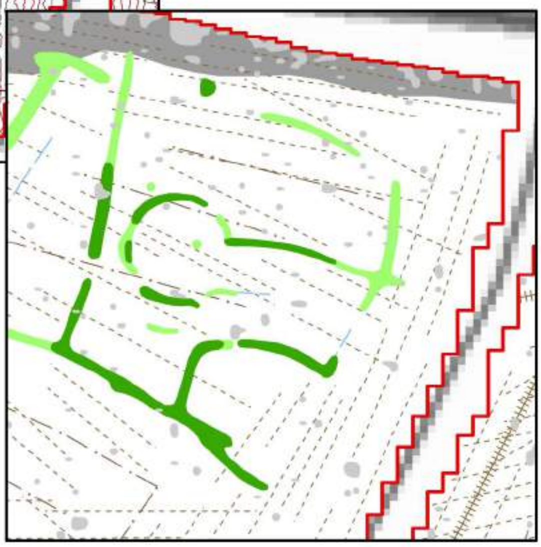
LEFORT GEOPHYSICS



A303 Sparkford to Ilchester Dualling, Main Compound

Gradiometer Survey Report





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A303 Sparkford to Ilchester Dualling, Main Compound

Gradiometer Survey Report

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Gradiometer Survey Report

Summary

A gradiometer survey was conducted over A303 Sparkford to Ilchester Dualling, Main Compound, some 1.25km east of Podimore, Somerset. The project was commissioned by L – P : Archaeology with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features on the site ahead of the proposed dualling of the A303 between Ilchester and Sparkford.

The site is located on a very gentle WNW facing slope to the east of Podimore, some 8.75km north of the centre of Yeovil. The site lies a short distance to the north of the Royal Naval Air Station Yeovilton. The survey area measures approximately 10.44ha and of this a total of 9.94ha has been covered by geophysical survey.

Two likely roundhouses and a third possible ring ditch were detected along with an associated enclosure and possibly associated field system remnants. The majority of responses suggest this area has long served a predominantly agricultural function. The remaining responses detected include ridge and furrow, trends of uncertain origin and possible palaeochannels.

The survey was undertaken by the Lefort Geophysics survey team between 16th and 22nd of January 2019.

Acknowledgements

The gradiometer survey was commissioned by L – P : Archaeology. The assistance of Kelly Madigan and Benjamin Sleep is gratefully acknowledged in this regard.

The fieldwork was undertaken by Ross Lefort and assisted by John Lefort and Dominic Lefort. Ross Lefort processed and interpreted the geophysical data in addition to producing this report.

A303 Sparkford to Ilchester Dualling, Main Compound

Gradiometer Survey Report

1. Introduction

1.1. Project Background and Survey Objectives

1.1.1. Lefort Geophysics was commissioned by L – P : Archaeology to carry out a geophysical survey over A303 Sparkford to Ilchester Dualling, Main Compound on the east side of Podimore, Somerset. The survey area is centred on NGR 355900, 124850 (**Figure 1**).

1.1.2. This survey forms part of a wider scheme of works being undertaken in advance of the proposed dualling of the A303 between Ilchester and Sparkford. The area selected for geophysical survey measures approximately 10.44ha.

1.1.3. The following aims have been set out for the geophysical survey:

- *To conduct a gradiometer survey that covers as much of the specified area as possible, allowing for surface obstructions.*
- *To determine the presence or absence of archaeological features, as far as the technique and site conditions will allow, and to map the extent of any features that may be present.*
- *To clarify the general nature and possible significance of the detected features.*
- *To produce a report of the survey results in sufficient detail to support an informed decision as to the site's archaeological potential.*

1.1.4. This reports sets out details of the site's location, the methodology followed, the survey results and the archaeological interpretation of the geophysical data.

1.2. Site Location and Topography

1.2.1. The site is located approximately 1.25km east of the centre of Podimore and some 8.75km north of the centre of Yeovil, Somerset. The survey area comprises two arable fields; the southern, western and northern extents are defined by field boundaries with the eastern extent defined by the limits of the proposed development (**Figure 1**).

1.2.2. The site occupies broadly flat land that slopes very slightly towards the WNW; the land is at a height between 20m and 25m above Ordnance Datum. A drainage ditch runs through the site boundary and this, along with a stream that flows past the site further south, eventually flows into the River Yeo to the south.

1.3. Geology and Soils

1.3.1. The bedrock geology under the site is recorded as interbedded mudstone and limestone deposits of the Langport Member, Blue Lias and Charmouth Mudstone Formations (undifferentiated) that dates to the Jurassic and Triassic Periods. No superficial deposits have been recorded under the site although Quaternary river terrace deposits of sand and gravel are recorded close by to the south (BGS).

1.3.2. The soils underlying the site are recorded as stagnogleyic argillic brown earths of the 572h (Oxpasture) association (SSEW 1983).

1.3.3. It is considered that soils derived from the parent material outlined above can produce contrasts suitable for the detection of archaeological features through geophysical survey.

1.4. Archaeological and Historical Background

1.4.1. The following information has been obtained from a cultural heritage Desk Based Assessment (DBA) carried out by Highways England (2018). The online database for the Somerset Historic Environment Record (HER) has also been consulted. The information considered to be of greatest relevance to the geophysical survey and its results will be summarized below.

1.4.2. No heritage assets are recorded within the site boundary although a number of records are recorded very close by. A cropmark field system is recorded to the south with a burnt layer identified to the east of the site. A milestone position is recorded to the north of the site, along the current route of the A303 (Highways England 2018: 107-129). The western end of the site is included within an area concluded to be of high archaeological potential (Highways England 2018: 125).

1.4.3. Archaeological works carried out in support of the wider dualling scheme, relevant to this survey, include a geophysical survey of surrounding fields followed by an archaeological evaluation (Sleep and Madigan 2019). These archaeological works revealed a number of settlement features ranging in date from the Neolithic through to the post-medieval periods. The greater number of these features dated to the Late Iron Age and Romano-British periods (Sleep and Madigan 2019: 70-75).

1.4.4. The investigated area most relevant to this survey is the eastern half of Field H; the western half of this field forms the eastern part of the current geophysical survey area. Field H revealed a concentration of roundhouses enclosure ditches and possible trackways with enough artefactual evidence recovered to securely date the features to the Late Iron Age and Romano-British periods (Sleep and Madigan 2019: 71-72).

2. Methodology

2.1. Introduction

2.1.1. Magnetometer survey was selected for the investigation of this site as this was deemed to be the most appropriate technique for the rapid assessment of a site in this geological setting. The survey was carried out using a Bartington Grad601-2 dual fluxgate gradiometer and was conducted in accordance with Historic England's guidelines (2008).

2.1.2. The survey was undertaken by the Lefort Geophysics survey team between 16th and 22nd of January 2019. Site conditions were variable with a wet muddy surface but a fairly even surface temperature throughout the survey. Of the proposed 10.44ha area a total of 9.94ha was covered by geophysical survey. The slight shortfall in coverage is due to the width of surrounding field boundaries.

2.2. Method

2.2.1. The survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument. Positional corrections are provided for this system by SmartNet which gives a precision of approximately 0.03m and therefore exceeds the Historic England minimum requirements for geophysical survey (2008).

2.2.2. The Bartington Grad601-2 gradiometer system has two sensor tubes set at a horizontal separation of 1m; this allows for two lines of data to be collected simultaneously. The upgraded system has an effective sensitivity of 0.03nT. Data were collected at 0.25m intervals along transects spaced 1m apart using the zigzag method. This survey strategy is in accordance with Historic England's minimum requirements for geophysical survey.

2.2.3. The survey data were subject to minimal correction processes using Geoplot. The processing functions used include:

- Group Zero Median Traverse (GZMT): This was applied to remove minor variations between the two Bartington sensors. This method of processing prevents the removal of archaeological features that run in-line with the traverse direction. Thresholds of ±5nT were applied.
- Zero Median Traverse (ZMedT): This was applied to all grids to remove minute variations between the two Bartington sensors left behind by GZMT. Thresholds of ±1nT were applied.
- Zero Mean Traverse (ZMT): This was applied to grids dominated by ferrous responses where GZMT failed to remove sensor variations. Thresholds of ±5nT were applied.
- Deslope: This was used on selected grids to correct minor grid edge discontinuities introduced by earlier processing steps.
- Destagger: This corrects small errors in traverse position introduced by varying topography and ground cover.

2.2.4. Further details of the survey equipment, fieldwork procedures and methods of processing are described in **Appendix 1**.

3. Results and Interpretation

3.1. Introduction

3.1.1. The gradiometer survey has been successful in identifying a number of anomalies of likely and possible archaeological interest. A number of other features have been detected including numerous agricultural features and many trends of uncertain origin. Results are presented as a series of greyscale plots, XY trace plots and archaeological interpretations at a scale of 1:1500 (**Figures 2** to **4**). The greyscale plots are displayed from -2nT (white) to +3nT (black) and the XY trace plots are displayed at ±25nT at 25nT per cm.

3.1.2. The interpretation of the dataset highlights the presence of potential archaeological features, modern features, geological responses, agricultural features and anomalies of uncertain origin (**Figure 4**). Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.

3.1.3. Numerous ferrous responses have been observed throughout the gradiometer dataset. These are presumed to be modern and are not referred to, unless they are considered relevant to an archaeological interpretation.

3.2. Gradiometer Survey Results and Interpretation

3.2.1. The most noticeable feature detected is a ring ditch at **1001** that appears to be set within a sub-rectangular enclosure. The ring ditch has a c.13m diameter with a clearly defined opening to the southeast; this would suggest it is a roundhouse. The opening is clearly defined by a ditch at **1002** that extends in an ESE direction with a weaker parallel feature visible at **1003** that is largely defined by a trend. An L-shaped ditch to the south at **1004** runs parallel to **1002** suggesting they are also related.

3.2.2. A number of other ditches at **1005** to **1007** join up with these features to form a wider sub-rectangular enclosure with a possible internal division formed by **1005**. The enclosure measures approximately 50m x 40m and looks to directly link up with some anomalies in the wider area to the west that are classed as ridge and furrow. This suggests the enclosure sits within a wider area primarily used for agricultural activity.

3.2.3. Not all of the apparent ridge and furrow running through the area is contemporary with this enclosure. There are differing alignments criss-crossing one another to the west of the enclosure with evidence of damage from later ridge and furrow visible in the ring ditch anomaly itself. There are weaker sections in the ring ditch that are defined as possible archaeology with some clear breaks where the ditch cannot be discerned at all.

3.2.4. Pit-like anomalies are visible within and close to the sub-rectangular enclosure. Some clearly defined examples, such as **1008**, have been classed as archaeology whereas weaker examples, such as one within the ring ditch itself, are classed as possible archaeology.

3.2.5. An L-shaped ditch at **1009** may be a remnant of a field system associated with this enclosure. It has been classed as possible archaeology due to its weak values.

3.2.6. Another likely ring ditch is visible further east at **1010**; this example is smaller at c.7m and less well defined. It is similar to the example above in that it has an apparent opening on its eastern side which may suggest it is a roundhouse.

3.2.7. Unlike the other example there is no clear surrounding enclosure but a nearby curving trend at **1011** could prove to be another weakly contrasting ring ditch. Ditch sections around **1012** and a nearby trend may also be related to the ring ditch in some way.

3.2.8. Pit-like responses lie close by with a strong example at **1013** classed as archaeology with weaker examples around **1014** classed as possible archaeology.

3.2.9. A probable field system is evident nearby with a double ditch at **1015** that looks to link up with a curvilinear feature at **1016** to **1017**. The curvilinear ditch appears to cross a large sub rectangular enclosure defined by ditches around **1018** and **1019** with similarly aligned ditches visible around **1020** and **1021**. It is unclear if these features constitute a single field system or are elements of multiple phases of landscape division. These ditches are largely classed as possible archaeology due to their weak magnetic values with the exception of the southern ditch at **1015** which is far stronger.

3.2.10. A number of parallel linear features are concentrated in the southeast corner of the dataset around **1022** and **1023**. These features are aligned with the nearby southern field boundary and are considered to possibly relate to this more recent phase of land use; for this reason these features are classed as agricultural. It should be noted that it is possible these features are older than their alignment suggests they may be.

3.2.11. A former field boundary is visible at **1024** to **1025** with some perpendicular drainage ditches visible around **1024**. This boundary is marked on the West Camel and Yeovilton tithe maps and marks the boundary between these parishes.

3.2.12. A group of weak ditches defines a gridded area at **1026** to **1028**. The northern edge of this grid, between **1026** and **1028**, runs up to a junction of known field boundaries. For this reason these ditches are classed as agricultural, possibly representing a drainage feature associated with the more recent field system.

3.2.13. A ditch runs parallel and perpendicular to surrounding modern field boundaries at **1029**. This may represent a former boundary not present on the historic mapping consulted and is therefore considered to be agricultural. A ditch at **1030** runs parallel to the nearby road and has been classed as agricultural for this reason.

3.2.14. Responses consistent with ridge and furrow run parallel on both sides of **1029**. A clearly defined region is visible around **1031**. Apparent ridge and furrow is visible on differing alignments elsewhere around **1032** to **1034**. Some of these features run on similar alignments to the enclosure ditches identified around **1001** and may therefore represent much earlier features.

3.2.15. Ceramic field drains cross the site at several locations such as around **1034** to **1036**.

3.2.16. An area of modern disturbance, defined as increased magnetic response, runs alongside the A303 at **1037** and **1038**; this is likely due to the concentration of modern magnetic material along the busy road. A wide band of increased magnetic response runs through the eastern end of the dataset, around **1031**. This may be due to concentrated human activity and may therefore prove to be of archaeological significance.

3.2.17. Two broad bands, characterised by variable positive magnetic values, run through the eastern field at **1039** to **1042.** These features are considered to be geological and either represent former watercourses or are bands of gravel. The strongest regions of these two bands have been classed as palaeochannels. A regular and strongly positive response at **1043** has been classed as possible archaeology. If it proves to be anthropogenic, this could represent some alteration to this natural feature to perhaps enhance drainage of the wider area.

3.2.18. There are several small sub-oval positive responses scattered across the dataset. These could prove to be isolated archaeological features, such as pits or postholes, but could equally represent natural features, such as tree throws, or are more deeply buried ferrous objects. Due to this uncertainty these features have been classed as possible archaeology.

3.2.19. The remaining responses are weak trends of uncertain origin; while its possible examples such as **1011** prove to be of archaeological interest it is likely many others are of agricultural or geological origin.

3.3. Gradiometer Survey Results and Interpretation: Modern Services

3.3.1. No clear modern services have been identified within the dataset.

3.3.2. It should be noted that gradiometer data will not be able to detect all services on site. Services made from non-ferrous material are unlikely to generate the distinctive response that would allow for a classification as a service. Plastic pipes are particularly hard to detect for example.

3.3.3. This report and accompanying illustrations should not be used as the sole source for service locations. Service maps should be consulted in addition to employing appropriate equipment (e.g. CAT and Genny) to confirm service locations before any invasive activities are carried out on site.

4. Conclusions

4.1.1. The gradiometer survey has been successful in identifying anomalies of likely and possible archaeological interest. A number of other features have been detected including numerous agricultural features and many trends of uncertain origin. The survey and this report are considered to have addressed all of the aims set out for the project.

4.1.2. The most significant features detected are the two probable roundhouses and their associated ditches and enclosures. The more clearly defined example at **1001** displays some seemingly unusual features such as long ditches extending outward from the likely entrance.

4.1.3. A possible third ring ditch is evident as a weak trend at **1011**. If proved to be a ring ditch, this feature could suggest that more ring ditches were present in this area with recent plough damage perhaps impacting on buried archaeological deposits. The roundhouse at **1001** shows probable signs of later agricultural damage with gaps and weaker regions visible around the ring ditch response.

4.1.4. Fragmentary field systems are evident in places across the dataset with most running near parallel to at least one nearby modern surviving boundary. This may suggest that the overall scheme of land division has not fundamentally changed since the phase of the ring ditches, with later boundaries following earlier ones. This could mean that some of the features classed as agricultural have earlier origins than they may at first appear.

4.1.5. The results of this survey are consistent with the results of the previous survey of the wider area of the scheme. More potential roundhouses have been identified, along with potential enclosure features, that may be broadly contemporary with the cluster of roundhouses already identified and dated further east within Field H (Sleep and Madigan 2019: 71-72).

4.1.6. Some of the features classed as ridge and furrow may prove to be drainage ditches and the term ridge and furrow should not be taken to indicate a medieval or post-medieval date. Some of these features line up with enclosure ditches surrounding the ring ditch at **1001** and may prove to be much earlier.

4.1.7. The majority of detected features relate to agricultural activity and suggest this area has largely served an agricultural function in recent centuries.

4.1.8. Gradiometer survey has a proven track record of identifying a wide range of archaeological features in a diverse range of geological settings. It is however a possibility that other archaeological features may exist that are not detectable through gradiometer survey. Stone walls composed of a sedimentary rock, for example, may not be visible on a site with similar underlying geology as there is no measurable magnetic contrast between the wall and the surrounding soil.

5. References

5.1. Bibliography

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5.2. Cartographic Sources

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APPENDIX 1: THEORY, SURVEY STRATEGY AND DATA PROCESSING

Basic Theory

Introduction

The two geophysical survey techniques carried out by Lefort Geophysics are magnetometer and earth resistance survey. Magnetometer survey is routinely used for archaeology due to the rapid area coverage achievable, in addition to its successful track record in many different geological settings. Earth resistance survey is slower by contrast, but can reveal archaeological features that may be missed by a magnetometer survey.

Magnetometer Survey

This technique involves measuring minor variations in the Earth's magnetic field; these variations are caused by a number of human induced and natural phenomenon. Humans can enhance the magnetic properties of soils in a number of ways; such as through the creation of ceramic/metallic objects, deposition of settlement waste and through burning. The resulting enhanced soils that fill pits and ditches make these features detectable.

Some natural phenomenon, like underlying geology and the sun, create large scale magnetic variations that can mask weaker archaeological features. A common way of filtering out these large scale effects is to collect data using two magnetometer sensors, one mounted at a fixed distance above the other. The lower sensor is closer to the ground and is therefore more sensitive to shallow, small scale changes; both sensors measure the large scale variations to a similar degree. When data from one sensor is subtracted from the other, the effect is to remove the large scale variations to reveal a clear picture of potential archaeological features. This configuration is known as a gradiometer and the system used by Lefort Geophysics works in this way.

There are several different types of magnetometer sensor available but the two most commonly used for archaeology are fluxgate and caesium vapour. The basic difference between the two is that caesium vapour measures the total strength of the magnetic field whereas fluxgate only measures a component of the field in a particular direction.

The advantages of the fluxgate sensors are their robust and lightweight design coupled with a lower power consumption; these factors make for an excellent piece of field equipment. Caesium vapour magnetometers are considered to be more sensitive with a lower noise level. In most cases this difference in sensitivity and noise is not enough to warrant use of caesium vapour over fluxgate sensors. Use of caesium vapour sensors is considered most advantageous when searching for deeply buried archaeological features.

Earth Resistance Survey

Earth resistance survey works, in simple terms, by passing a weak electrical current through the soil and measuring variations in electrical resistance. Resistance varies according to differences in soil moisture content and by the presence of materials of varying resistivity. A wall, for instance, is likely to be dry and composed of poor conducting materials; this results in a high measured resistance value. A ditch filled with wetter, better conducting material will register a lower resistance value by contrast.

Four electrodes are used to measure resistance, two pass a fixed electric current through the ground (current probes) and the other two sample the voltage required to drive this current (voltage probes). The variations in voltage required to drive the current are indicative of the varying electrical resistance. The four electrodes can be arranged in a variety of different configurations, the twin-probe array is the widest used of these. The twin-probe involves grouping the four electrodes into two pairs, with a current and voltage probe in each pair. The pairs are separated by a large distance with one set in a fixed position and the other moved across the survey area to sample the varying resistance.

In general terms, the wider the electrode spacing, the deeper the technique can penetrate. The catch is that a wider electrode spacing increases the volume of soil sampled. This can result in smaller features, such as internal walls, being less detectable when investigating to greater depths. The standard probe separation used for commercial archaeology is 0.5m and this is considered suitable for the investigation of most rural sites in Britain.

The main weakness of earth resistance survey is that the quality of results are dependent on climatic conditions on the day and in the weeks running up to the survey. If the site is waterlogged then there is little contrast, the same is true if the site is too dry. This constraint puts the technique at a disadvantage in the commercial sector where waiting for the right conditions is not always possible.

Detailed Survey Methodology

Magnetometer data is collected using a Bartington Grad601-2 dual fluxgate gradiometer system. This has two sensor tubes mounted at a horizontal separation of 1m which allows for the simultaneous collection of two transects of data. Each sensor tube contains two fluxgate sensors arranged as a vertical gradiometer at a separation of 1m. This system can suppress large scale variations that might obscure potential archaeological features.

The Bartington Grad601-2 has an effective sensitivity of 0.03nT when set at a range of ±100nT in grid mode. The standard resolution for a geophysical survey is to collect readings at 0.25m intervals along transects spaced 1m apart. Data is collected in grids measuring 30m x 30m and at the resolution outlined above results in 3600 readings per grid. Higher sample density surveys can be carried out at a 0.125m separation along transects spaced 0.25m apart. This results in 28800 readings per 30m grid.

Magnetometer data can also be collected on the Lendiniae cart system. On this system multiple Bartington Grad601-2 can be mounted with positions logged by a Trimble 4800 base and rover GPS system. The advantage of using this system is that each reading has greater positional accuracy compared to grid based data collection. The Trimble 4800 system is capable of a horizontal accuracy of ±1cm and a vertical accuracy of ±2cm.

The earth resistance data is collected using a Geoscan Research RM15 system using the twin-probe array. The mobile electrodes are mounted on a fixed bar with a multiplexer (MPX15) used to allow two transects of data to be collected simultaneously. A probe separation of 0.5m is typically used with data collected at 1m intervals along transects spaced 1m apart, in line with English Heritage minimum requirements.

The 30m x 30m survey grid nodes and base points for the Trimble 4800 system are accurately established in the field using a Leica Viva series RTK GNSS instrument. This system achieves a high level of precision thanks to a network of reference stations operated by the Ordnance Survey and Leica Geosystems, known as SmartNet. These reference stations provide positional corrections that are fed to the system via a mobile internet connection. This enables the system to achieve an accuracy of 0.03m which exceeds the English Heritage minimum requirements (2008).

Data Processing Methodology

The collected gridded gradiometer data are downloaded from the Bartington system using the software provided. Data are saved in a Z format with a separate header file generated for survey parameters. Data are then imported into the processing software Geoplot to correct minor errors. These corrections aim to enhance the results for greater clarity. The processing applied is minimal with no filtering or interpolation used.

The processing steps for gridded data include Group Zero Median Traverse (GZMT) followed by a narrow threshold Zero Median Traverse (ZMedT). This method of processing allows variations between the Bartington sensors to be removed while minimising the potential loss of features that run in line with traverse direction. Other processing steps include deslope, and destagger with Zero Mean Traverse (ZMT) applied to selected ferrous dominated grids.

GZMT works by grouping the 30 traverses of data into four groups according to the sensor used and its orientation during data collection. The median values of each line of data are calculated and from these results an overall median value for each of the four groups is calculated. These four values are used to correct each of the 30 traverses. This is then followed up with ZMedT; this removes minor variations that are a result of instrument drift and preserves archaeological features thanks to a very narrow threshold.

The ungridded magnetometer cart data are downloaded from the acquisition software Nav601 and positions for each reading are calculated in Trackmaker601. This results in an XYZ file of the magnetometer data that can be processed. Gridded data is processed in MagPick to remove variations between Bartington sensors. The most common processing applied is a linear filter to remove variations between sensors.

The earth resistance data are downloaded in Geoplot in the .grd file format. Minor data corrections are then applied in Geoplot. The main difference from the processing of gradiometer data is that filtering is applied to earth resistance data.

The typical processing steps applied to earth resistance data are as follows:

- Despike: Removes anomalous data points that can arise during data collection.
- Edge Match: Corrects for differences between grids that arise when survey is carried out on different days or through the movement of the fixed probes.
- Multiply: This multiplies data in a selected area by a specified positive or negative value and alongside edge match is useful for the correction of grid differences.
- Low Pass Filter: This is used to remove small scale spatial detail and is useful for enhancing broad, weak anomalies.
- High Pass Filter: This removes large scale spatial detail and is useful for filtering out broad geological responses that could obscure archaeological features.

Two methods of data display are used to show gradiometer data: greyscales and XY trace plots. For the display of earth resistance data greyscale plots are used only.

- Greyscale: Presents the data in plan view with a shade of white, grey or black assigned to each reading according to its magnetic or resistance value. At the standard survey resolution each rectangular pixel corresponds to a reading.
- XY Trace: Presents each line of the magnetic data as a graph line with multiple lines overlapping to produce a stack of profiles. The graph running upwards signifies a positive anomaly (red) and running down (black) indicates a negative. This is of help in further characterising a magnetic anomaly as either archaeological or ferrous.

APPENDIX 2: INTERPRETATION CATEGORIES

The interpretation methodology used by Lefort Geophysics divides anomalies into five main categories: archaeological, agricultural, modern, geological and uncertain origin.

The archaeological category is used where a detected anomaly presents a shape or configuration that looks to be indicative of a buried archaeological feature. Further sources of information including aerial photography and historic maps may be incorporated into the final interpretation. This category is sub-divided into two groups based on levels of confidence in the interpretation.

- Archaeology – this is used to classify anomalies with a clear anthropogenic pattern that do not appear to relate to modern or agricultural features.
- Possible Archaeology – this is used for anomalies that give a fairly regular pattern but cannot be discounted as relating to modern, agricultural or geological features.

The modern category is used for anomalies that are presumed to be relatively recent in date. Modern is sub-divided into two categories as follows:

- Ferrous – used for anomalies characterised by a dipolar or bipolar response. Such anomalies can be caused by the presence of iron and ceramic material and are assumed to be modern in origin.
- Modern Service – used for responses considered to correspond to buried pipes and cables. Most detectable services are made from ferrous or ceramic materials.

The agricultural category is sub-divided into five categories as follows:

- Former Field Boundary – used for anomalies that are shown to correspond to the positions of field boundaries marked on historic maps.
- Agricultural – used for anomalies that follow known agricultural features or run parallel to them but do not appear on historic mapping.
- Ridge and Furrow – these are defined by broad and diffuse linear positive and negative anomalies. Ridge and furrow are broad strips of raised ground with parallel ditches that were cultivated during the medieval and post-medieval periods.
- Ploughing – used to define narrow linear trends running through the data created by ploughing scars in the soil.
- Drainage – used to define ceramic field drains or ditches running through a field that are used to keep the soil well drained. Ceramic drains are identified by their distinctive anomaly form whereas ditched drains are identified more by their layout.

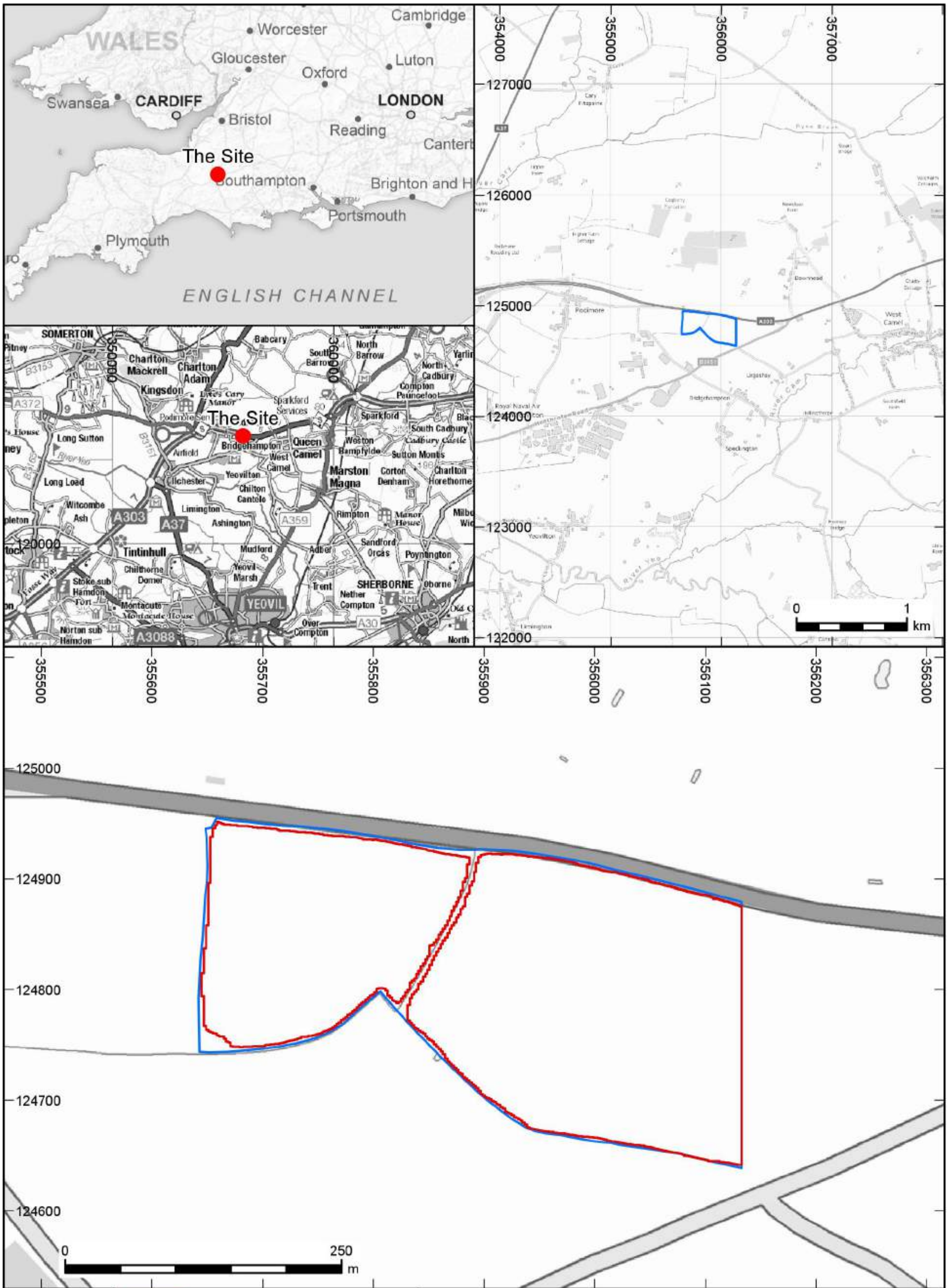
The geological category defines areas of broad and diffuse responses that are not considered to be archaeological. There are two sub-divisions of this category:

- Superficial Geology – used to define broad spreads of responses considered to relate to shallow geological deposits.
- Palaeochannel – used to define linear and curvilinear anomalies that are considered to represent former watercourses.

The uncertain origin category is used for anomalies that cannot be classified confidently in any of the four categories outlined above. There are two sub-divisions of this category:

- Increased Magnetic Response – used to define areas of varying magnetic responses.
- Trend – weak narrow linear responses that do not seem to relate to ploughing.

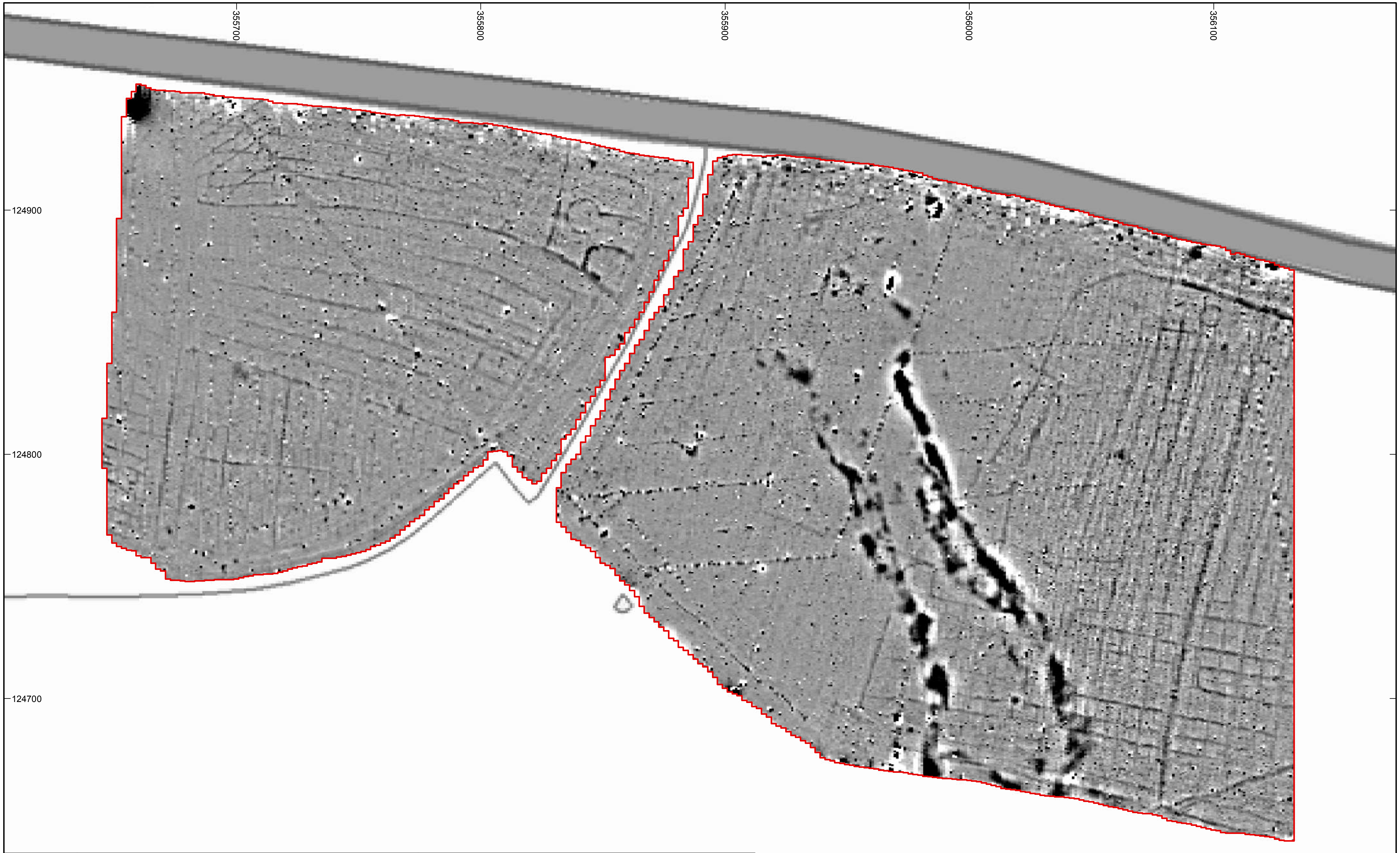
Other categories may be added in some instances to account for unusual features or where a project specification requires more detailed interpretation. Any additions will be outlined in the introduction of the results section of the survey report.



	Gradiometer Survey Extents	Contains OS data © Crown copyright [and database right] (2015)			
	Site Boundary	This material is for client report only © Lefort Geophysics. No unauthorised reproduction.			
	N	Date:	27/01/2019	Revision:	0
		Scale:	1:5,000,000; 1:250,000; 1:50,000 and 1:5000 at A4	Illustrator:	RDL

Site location and gradiometer survey extents

Figure 1



Gradiometer Survey Extents

0 50 m

-2nT +3nT

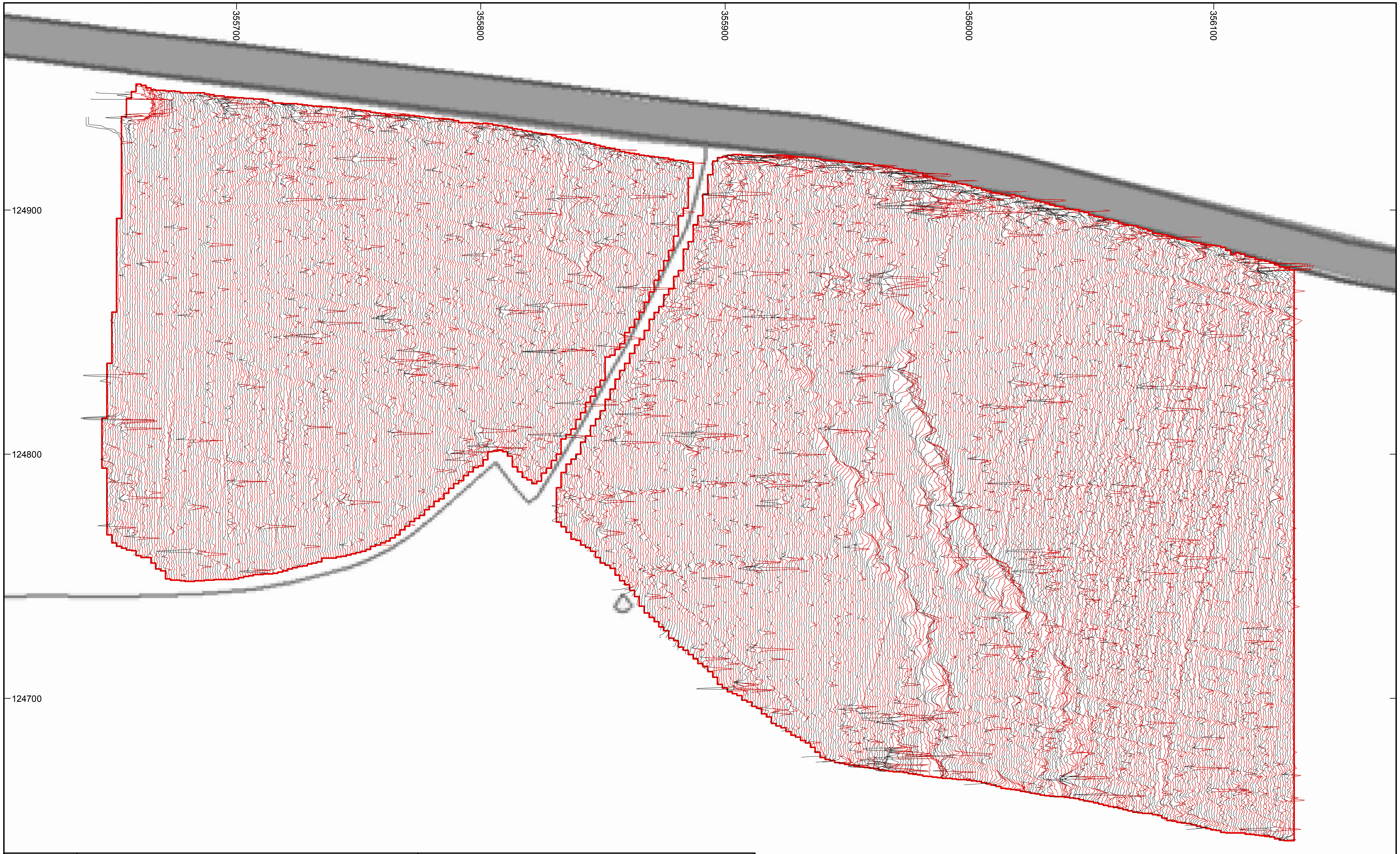
N

Processing History
Group Zero Median Traverse: ±5nT thresholds applied to all grids
Zero Median Traverse: ±1nT thresholds applied to all grids
Zero Mean Traverse: ±5nT thresholds applied to selected ferrous dominated grids
Deslope: applied to selected grids to remove grid edge discontinuities
Destagger: -2 shift applied to all grids with further shifts of +/-1 applied to selected grids and traverses

Date:	27/01/2019	Revision:	0
Scale:	1:1500 at A3	Illustrator:	RDL

Greyscale plot

Figure 2



Gradiometer Survey Extents

0 50 m

-25nT +25nT

N

Processing History
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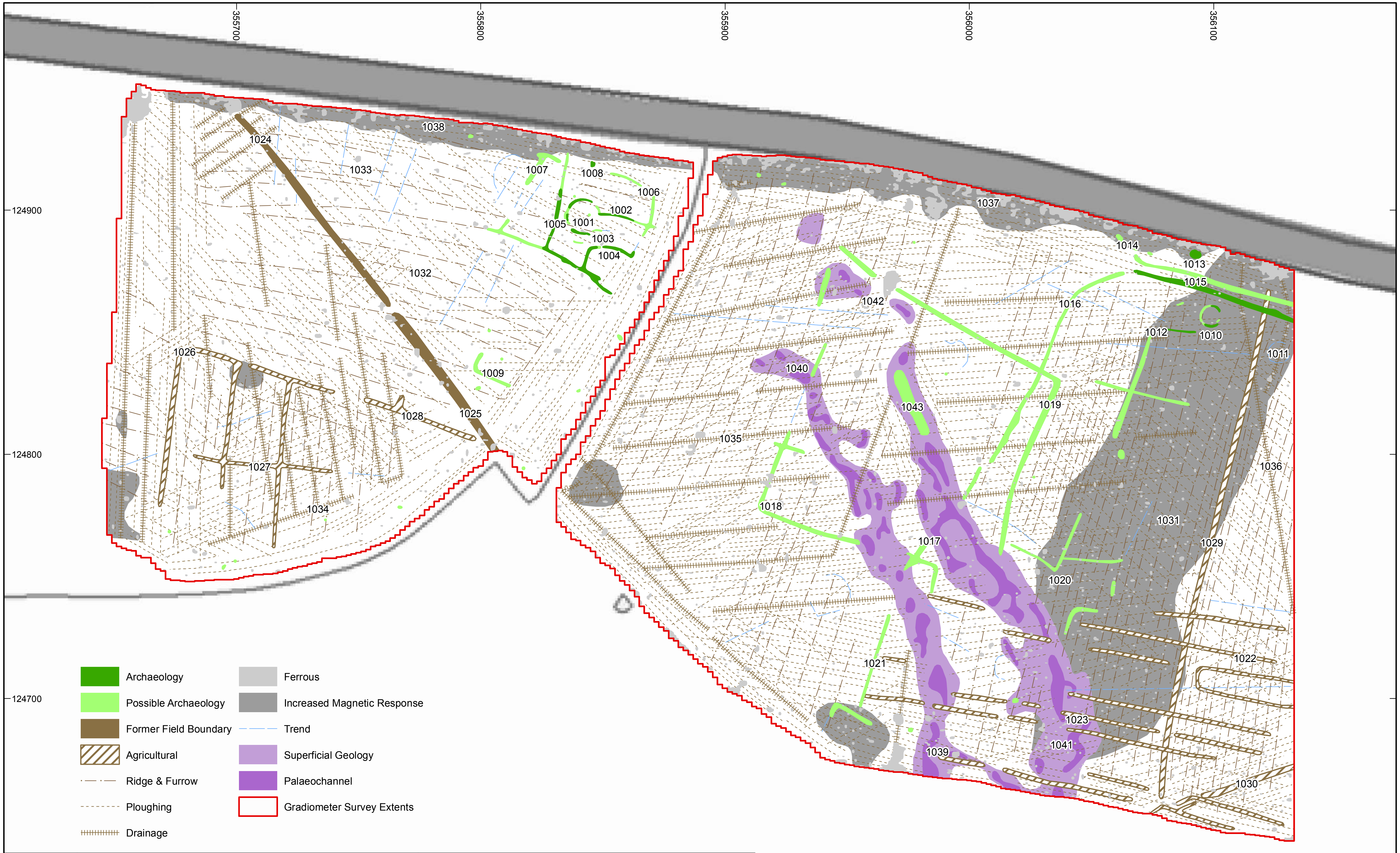
Zero Median Traverse: ±1nT thresholds applied to all grids
Zero Mean Traverse: ±5nT thresholds applied to selected ferrous dominated grids
Deslope: applied to selected grids to remove grid edge discontinuities
Destagger: -2 shift applied to all grids with further shifts of +/-1 applied to selected grids and traverses

Date:	27/01/2019	Revision:	0
Scale:	1:1500 at A3	Illustrator:	RDL

XY trace plot

Figure 3



Processing History
Group Zero Median Traverse: ±5nT thresholds applied to all grids
Zero Median Traverse: ±1nT thresholds applied to all grids
Zero Mean Traverse: ±5nT thresholds applied to selected ferrous dominated grids
Deslope: applied to selected grids to remove grid edge discontinuities
Destagger: -2 shift applied to all grids with further shifts of +/-1 applied
to selected grids and traverses

Date:	27/01/2019	Revision:	0
Scale:	1:1500 at A3	Illustrator:	RDL