A9 DUALLING
PERTH TO INVERNESS

Appendix 15.3

Archaeological Geophysical Survey Report

Transport Scotland

August 2018

TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

ATKINS mouchel

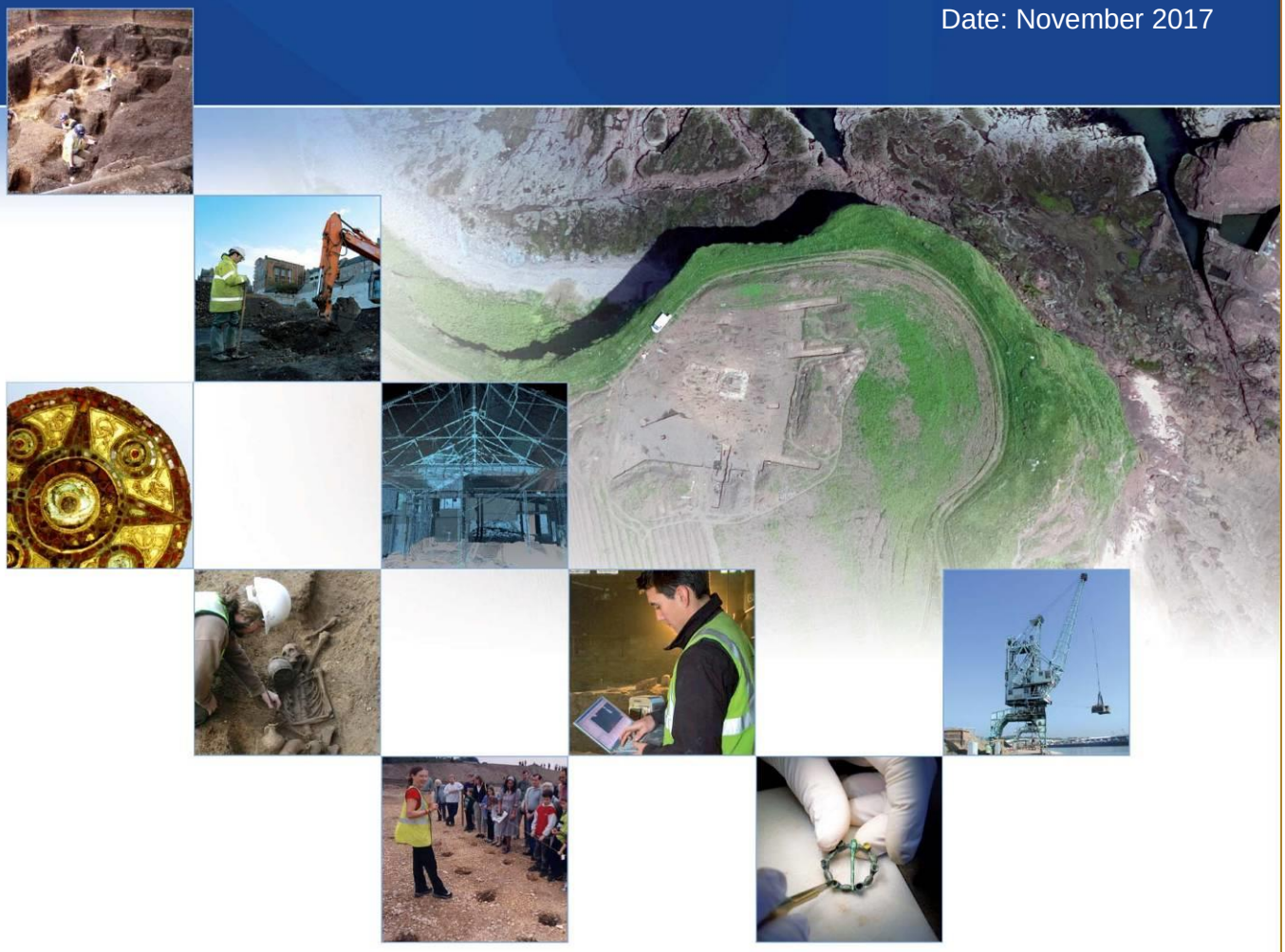
A9 Dualling – Northern Section
Dalraddy to Slochd
Scotland

Archaeological Geophysical Survey

National Grid Reference: NH 86815 10080 to NH 90963 17773

AOC Project No: 51846

Date: November 2017



AOC Archaeology Group

ARCHAEOLOGY | HERITAGE | CONSERVATION

A9 Dualling – Northern Section

Dalraddy to Slochd, Scotland

Archaeological Geophysical Survey

On Behalf of:

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National Grid Reference (NGR): **NH 86815 10080 – NH 90963 17773**

AOC Project No: **51846**

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Date of survey: **21/11/17 – 30/11/17**

This document has been prepared in accordance with AOC standard operating procedures.

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Non-Technical Summary

AOC Archaeology Group was commissioned by Atkins Mouchel Joint Venture (hereafter 'AMJV') to undertake an archaeological geophysical survey (gradiometer and earth resistance) to investigate the potential for buried archaeological remains along the route of the Northern Section of the A9 Dualling Programme, on behalf of Transport Scotland.

The gradiometer survey focusses on four specific survey parcels located between Dalraddy and Slochd (NH 86815 10080 to NH 90963 17773) totalling an area of approximately 8 hectares (ha) across mixed pasture land. The earth resistance survey targeted features of interest observed in the gradiometer survey results.

The gradiometer survey results identified a number of linear and curvilinear trends, as well as a number of areas of magnetic disturbance, all with unclear origins. The anomalies in particular are weak in form compared to the natural geology of the area and it is difficult to interpret whether these anomalies have an archaeological origin or if they are more natural in form.

In Area 1, a number of weak linear trends were identified alongside a couple of discrete pit like features, all of unclear origins. A possible service was also detected.

In Area 2, large swathes of geological variations were identified in the dataset along with a number of trends and areas of magnetic disturbance of an unclear origin. In particular, the unclear trends in the south of the dataset were detected in the earth resistance results and are likely to be archaeological in origin. Features of a modern origin were also detected.

In Area 3, similar swathes of geological variations were also interpreted as well as areas of modern disturbance. Unclear trends were also identified which could have archaeological origins.

In Area 4, four areas of magnetic disturbance were interpreted as well as several linear and curvilinear trends, all of which have unclear origins. In particular an amorphous trend in the north of the area was also identified in the earth resistance results which could have archaeological origins. A possible service was also identified as well as a small area of geological variations.

A number of areas of magnetic disturbance most likely the result of modern activity were also recorded across all datasets as well as a number of ferrous anomalies.

1 Introduction

1.1 AOC Archaeology Group was commissioned by AMJV to undertake an archaeological geophysical survey as part of the proposed upgrade and dualling of the Northern Section of the A9 Dualling Scheme. This work is part of a wider scheme of archaeological assessment being undertaken along the proposed dualling section on behalf of Transport Scotland.

1.2 The survey was carried out to provide information on the extent and significance of potential buried archaeological remains within the specified land parcels.

2 Site Location and Description

2.1 The four parcels allocated for geophysical survey are located along the southbound edge of the A9, in between Dalraddy and Slochd, approximately 25 – 32 miles south of Inverness. The survey areas total approximately 8ha (see Figure 1).

2.2 Area 1 is the southernmost survey area, located to the north of Loch Alvie and south of the A9 (centred at NH 86815 10080). The survey area covers approximately 1ha across a single pasture field containing a steep embankment towards the A9 in the north, which was unsurveyable. A small burn was located to the east of the survey area.

2.3 Area 2 is located to the east of Loch Alvie and to the south of the A9 (centred at NH 87723 10201). The survey area covers approximately 5ha across three fields, separated by metallic fencing. The survey areas consist of rough pasture, with sections of woodland present in the east and north-west. Agricultural debris such as feeding troughs and silage along with several telegraph poles presented small obstructions to the survey. The ground level slopes down towards the A9 in the north of the survey area.

2.4 Area 3 is the northernmost survey parcel and is located south of Kinveachy to the west of Loch Vaa, on the eastern side of the A9 (centred at NH 90942 17646). The survey area covers approximately 3ha across a single pasture field containing two holding ponds which were unsurveyable. A large stony mound was located in the south-west of the survey area which also presented as unsurveyable. The ground level sloped up in the eastern and western extents due to the railway and A9 embankments.

2.5 Area 4 is located to the south of Area 3, to the north of Avielochan (centred at NH 90699 17110). The survey area covers approximately 2.5ha across two pasture fields which are separated by a trackway and metal fencing. A holding pond is located in the northern field along with dense woodland along the western edge of the area, presenting unsurveyable areas. The embankment to the A9 presented an unsurveyable section in the southern survey area.

2.6 Survey Area 1 is relatively level at approximately 220m aOD (above Ordnance Datum) with a steep slope leading from the A9 in the north of the survey area from approximately 230m aOD. Survey Area 2 is also relatively level and is situated approximately 220m aOD. Area 3 is situated between 240m to 250m aOD however is relatively level. Survey Area 4 is similarly situated at approximately 240m to 250m aOD and ground level is slightly undulating in the southern survey area.

2.7 The bedrock recorded geologies for the four specified parcels are taken from the WSI for Archaeological Geophysical Survey (AMJV, 2017).

2.8 In Area 1 the bedrock recorded geology is the Monadhliath Pluton, consisting of porphyritic Silurian granites. These are overlain by Quaternary fluvial alluvial fan deposits of gravel, sand, silt and clay. These are overlain by Humus-iron podzols (Scotland's Soils, 2017).

2.9 In Area 2 the bedrock recorded geology is the Loch Laggan psammite formation, consisting of a metamorphic bedrock. These are overlain by Devensian glaciofluvial sheet deposits of sand, gravels and boulders. These are overlain by Humus-iron podzols (Scotland's Soils, 2017).

2.10 In Areas 3 and 4 the bedrock recorded geology is the Boat of Garten pluton, porphyritic tonalite and porphyritic igneous Silurian bedrocks. These are overlain by Devensian glaciofluvial gravels, sands and silts. These are overlain by Humus-iron podzols (Scotland's Soils, 2017).

3 Archaeological Background

3.1 The archaeological background below is drawn from the Written Scheme of Investigation for Archaeological Geophysical Survey (AMJV, 2017) and a search performed on Canmore (Canmore, 2017).

Prehistoric

3.2 Very little evidence relating to the Palaeolithic and Mesolithic periods survives in the Highlands. No finds dating to the Palaeolithic are recorded on the HHER, and those which are assigned a Mesolithic date mainly consist of lithic scatters representing stone tool working sites. The lack of Palaeolithic sites may be due to the fact that the end of this period coincides with the retreat of the ice sheet which covered Scotland during the Ice Age.

3.3 No sites dating to the Mesolithic period are known within the study area.

3.4 The transition from Mesolithic to Neolithic saw a gradual preference for more permanent settlement, and the keeping of livestock and farming, a tradition that carried on into the Bronze and Iron Ages. Sites dating from the Neolithic and the Iron Age are found throughout the study area and consist of settlement sites, field systems and burial monuments.

3.5 Less than 500m west of survey Area 1, a Cairn, Hut Circle and Ring Cairn, dated to possible Prehistoric and Neolithic / Bronze Age is located (Canmore ID 14891).

3.6 To the south-east of survey Area 4 by less than 500m, a chambered Bronze Age cairn is located and is said to have contained bone and jet fragments (Canmore ID 15396). Approximately 190m north of survey Area 3, a Bronze Age Flax Axehead was discovered in 1971 (Canmore ID 15395).

3.7 Towards the end of the Iron Age (and spanning into the beginning of the Early Medieval), documentary sources make reference to Picti or painted people. The Picts produced characteristic carved stones which are found throughout the Highlands and Islands. A Pictish carved stone is located within the study area.

3.8 Less than 200m west of Area 4, the prehistoric Fort Avielochan is located, measuring over 60m in width (Canmore ID 15387). An unassigned crannog is located on an Island in Loch Vaa, just to the east of survey Areas 3 and 4, which shows above water in dry weather (Canmore ID 15385).

Early Medieval / Pictish & Medieval

3.9 The dominant site types from the medieval period are churches and administrative sites such as Mottes and Castles. A number of sites dating to this period survive within the study area, such as Doune Motte.

3.10 An undated Cairn is reputed to have been located just 70m south of survey Area 4 (Canmore ID 15401) and though no trace of it now remains and the exact location is unknown, a possible Viking / medieval pinhead was found under one of the cairn's stones.

17th & 18th Century

3.11 Remnants of General Wade's Military Road survive in various stretches within the study area, however sections of it have been destroyed by the construction of the current A9.

4 Aims

4.1 The aim of the geophysical survey was to identify any potential archaeological anomalies that would enhance the current understanding of the archaeological resource within the proposed survey area.

4.2 Specifically the aims of the survey were;

- To identify any geophysical anomalies of a possible archaeological origin within the specified survey areas;
- To accurately locate these anomalies and present the findings in map form;
- To describe the anomalies and discuss their likely provenance in a written report;
- To recommend any further work likely to contribute to the mitigation of the impacts of the scheme on these features; and
- To incorporate all of the above in a report and comprehensive site archive for AMJV / Transport Scotland.

5 Methodology

5.1 All geophysical survey work was carried out in accordance with recommended good practice specified in guideline documents published by English Heritage – now Historic England (David *et al.* 2008) and the Chartered Institute for Archaeologists *Standard and Guidance for archaeological geophysical survey* (2014).

5.2 Parameters were selected that were suitable for the prospective aims of the survey and in accordance with recommended professional good practice (David *et al.* 2008, 8).

5.3 The gradiometer survey was carried out using Bartington Grad601-2 fluxgate gradiometers (see Appendices 2 and 3). Data was collected on an east-west alignment using zig-zag traverses, with a sample interval of 0.25m and a traverse interval of 1m. A total of 163 full or partial 30m by 30m grids were surveyed within the specified area, totalling an area of approximately 8ha.

5.4 The gradiometer data were downloaded using Bartington Grad601 PC Software v313 and processed using Geoscan Geoplot v3.0 / v4.0. The details of these processes can be found in Appendices 4 and 5. Data processing, storage and documentation were carried out in accordance with the good practice specifications detailed in the guidelines issued by the Archaeology Data Service (Schmidt and Ernenwein, 2009).

5.5 Attention was taken to avoid metal obstacles present within the survey area during data collection using gradiometers. Gradiometer survey is affected by 'above-ground noise' such as metal objects, and avoiding these improves the overall data quality and results obtained.

5.6 The Earth Resistance survey was carried out over specific targets of interest observed in the gradiometer survey results.

5.7 The Earth Resistance survey was carried out using a Geoscan Research RM15 resistance meter, utilising a MPX15 multiplexor attachment (see Appendices 2 and 3). Data was collected on an east-west alignment using zig-zag traverses, with a sample interval of 0.5m and a traverse interval of 0.5m. A total of 31 full or partial 15m by 30m grids were surveyed.

5.8 The Earth Resistance data were downloaded and processed using Geoscan Geoplot v3.0 / v4.0, and the details of these processes can be found in Appendices 4 and 5.

5.9 Interpretations of the data were created as layers in AutoCAD LT 2009 / GIS and the technical terminology used to describe the identified features can be found in Appendix 6.

6 Results and Interpretation

6.1 The gradiometer survey results have been visualised as greyscale plots, with the minimally processed data plotted at -1nT to 2nT in Figures 3, 6, 9, and 12. The Earth Resistance survey results have also been visualised as greyscale plots, with the minimally processed data plotted alongside the gradiometer data in Figures 15, 17 and 19.

6.2 The processed gradiometer data is also plotted at -1nT to 2nT and can be seen in Figures 4, 7, 10, and 13. Interpretations of the data can be seen in Figures 5, 8, 11 and 14. The processed Earth Resistance data can be seen alongside interpretations of the data in Figures 16, 18 and 20. An individual characterisation of the identified anomalies follows the figures in Appendix 1.

Gradiometer Survey Results

Area 1

Archaeology

6.3 No responses indicating definitive archaeological remains have been located in the survey area.

Linear Trends – Unclear Origins

6.4 Five negative linear and curvilinear trends are visible in the dataset for Area 1 (**A1 – A2**). Anomalies of this type are classed as trends of a linear / curvilinear form which are composed of a weak or different change in magnetic values. Coupled with poor patterning, the anomaly is difficult to interpret and it is unclear whether it has an archaeological origin.

6.5 In the south-east of the dataset, two negative linear anomalies run north-east to south-west and north-west to south-east, appearing to form a weak rectilinear form (**A1**). These lie to the west of a weak negative sub-circular anomaly of a similar form. Though these anomalies could have an archaeological origin, it is more likely that they have natural or geological origins.

6.6 Similar negative trends are visible in the west of the dataset, running north-east to south-west and west-east (**A2**). Again it is difficult to ascertain if these are more natural in origin.

6.7 To the north of these, a weak positive trend runs roughly east-north-east across the north-west of the dataset (**A3**).

Discrete Pits

6.8 In the west of the dataset for Area 1, two discrete pit like features have been identified (**A4**). These are typically classed as anomalies composed of an increase in magnetic values with a patterning on the XY trace plot that is suggestive of buried remains, such as the infill of a pit, but are isolated in their location and association with other features.

6.9 The pits are located south and west of several linear and curvilinear trends which all could be archaeological in origin, though the structure and patterning of all of the possible features identified do not represent anything obvious and could all be natural in origin.

Non-Archaeology

6.10 A possible service has been identified, running roughly east-north-east across the north of the dataset (**A5**). The anomaly also coincides with a footpath observed in the field at the time of survey, which could relate to the magnetic disturbance observed around the service anomaly.

6.11 A number of further areas of magnetic noise have also been detected in the north-east of the dataset, relating to an embankment in the north of the area as well as a field gate and entranceway. Areas of modern disturbance are characterised by significant increases or decreases in values compared with background readings.

6.12 Across the data set there is a small quantity of isolated dipolar anomalies (iron spikes). These are commonly caused by ferrous or high magnetically susceptible material on the surface or within the topsoil of the site, and it is likely that modern agricultural activity has changed the magnetic properties of the top soil and created a high level of background 'noise' within the data set.

Area 2

Archaeology

6.13 No responses indicating definitive archaeological remains have been located in the survey area.

Linear Trends & Magnetic Disturbance – Unclear Origins

6.14 A number of linear, curvilinear and amorphous trends can be seen across the dataset that are unusual and have no obvious patterning, which have therefor been classed as having unclear origins.

6.15 In the centre of the dataset, a broad rectilinear negative trend can be seen which could be archaeological in origin (**B1**).

6.16 To the north of this, a number of mixed positive and broad negative linear trends, as well as some very tentative rectilinear trends, are visible in the dataset (**B2**). Whilst some of these may be archaeological in origin, some may relate to geological variations as a slope was observed in this part of the survey area.

6.17 A weak curvilinear trend runs north-east through the dataset to the north of these trends (**B3**). The trend is located around the break of a slope and could be more natural in origin.

6.18 A positive linear trend running to the north-east in the north-east of the dataset could have archaeological origins (**B4**). It corresponds with a trackway observed in the field at the time of the survey, however the age of the track is unclear and it could be historical.

6.19 Further rectilinear positive trends can be seen in the centre-west of the dataset (**B5**).

6.20 Weaker curvilinear and linear trends have been observed in the centre (**B6**) and south-east (**B7**) of the dataset which also have unclear origins due to their magnetic strength.

6.21 In the north-west of the dataset, a broad negative rectilinear trend could be archaeological in origin (**B8**).

6.22 Magnetic disturbance of an unclear origin can be seen in the centre of the dataset (**B9** & **B10**). These consist of a variety of increased and decreased magnetic values compared with background readings and lack sufficient patterning or context for a conclusive interpretation. It is likely that these readings are caused by modern disturbances, but interpretation is tentative.

6.23 In particular the magnetic disturbance in the north of the dataset consists of mixed positive and negative magnetic readings and is unusual in form (**B9**), however the anomaly could relate to geology and the adjacent break of slope.

6.24 Magnetic disturbance observed in the centre-east of the dataset (**B10**) coincides with where a modern farm track runs north-west to south-east. A small embankment was observed alongside the track in this location which could be archaeological in origin, hence classing the anomaly as having uncertain origins.

Discrete Pits

6.25 A discrete pit like feature has been identified in the east of the dataset for Area 2 (**B11**) in the centre of an area of geology.

Geology

6.26 Strong geological variations can be seen across the dataset which is typical of magnetometer results in Scotland. These are described as areas of disturbance that are composed of irregular significant increases or decreases in magnetic values compared with background readings and are likely to indicate natural variations in soil composition or geology.

6.27 In the north-east of Area 2, geological variations can be seen consisting of strong positive and negative curvilinear trends (**B12**).

6.28 Similar curvilinear swathes of geology are visible in the west of the dataset (**B13** & **B14**).

6.29 In the centre-south of the dataset, geological variations consisting of groups of mixed strong positive and negative anomalies can be seen (**B15** – **B17**).

Non-Archaeology

6.30 A number of areas of magnetic disturbance can be seen across the dataset, which have modern origins such as sheep feeding troughs, boreholes and telegraph poles.

6.31 In the north of the dataset, two linear zones of magnetic disturbance tracking north-east and south-east across the area (**B18** – **B19**) relate to a trackway running through the area. In particular anomaly **B19** could relate to magnetic disturbance **B10**.

6.32 Magnetic disturbance in the south-east of the dataset relates to modern disturbance and debris observed in the field at the time of survey (**B20**).

6.33 Magnetic disturbance around the survey area boundaries relates to modern magnetic boundary fencing.

6.34 Iron spikes have also been identified across the dataset for Area 2.

Area 3

Archaeology

6.35 No responses indicating definitive archaeological remains have been located in the survey area.

Linear Trends – Unclear Origins

6.36 In the north of the dataset a positive rectilinear trend has been identified (**C1**) however due to the weak magnetic strength, it is unclear if the trend is archaeological in origin.

6.37 Linear trends consisting of mixed positive and negative values can be seen in the centre of the dataset running north-west to south-east (**C2**), in a ‘T’ shaped patterning (**C3**) and north-south-west (**C4**). These could relate to possible pipes or drains in the area, relating to the adjacent modern holding ponds, or they could represent geological variations.

Geology

6.38 Geological variations consisting of mixed strong positive and negative values can be seen throughout the dataset for Area 3 (**C5** – **C6**).

6.39 In the south-east of the dataset, the large geological variation most likely relates to a waterlogged area observed in the field at the time of survey (**C6**).

Non-Archaeology

6.40 A number of areas of magnetic disturbance can be seen across the dataset, which most likely have modern origins. In the north-east of the dataset, the magnetic anomaly looks similar to some of the geological variations observed in the rest of the dataset (**C7**) and it is difficult to ascertain whether this is modern, or also geological in origin.

6.41 In the south-west of the dataset, an area of magnetic disturbance most likely relates to the modern holding pond it is located next to (**C8**).

6.42 Iron spikes have also been identified across the dataset for Area 3.

Area 4

Archaeology

6.43 No responses indicating definitive archaeological remains have been located in the survey area. Given the close proximity of an unassigned cairn just 70m to the south of the survey area, it is suggested that some of the unclear trends could have archaeological origins and relate to the cairn.

Linear Trends & Magnetic Disturbance – Unclear Origins

6.44 In the north of the dataset for Area 4, an amorphous anomaly consisting of a sub-circular negative trend surrounding a positive trend can be seen alongside smaller positive amorphous trends (**D1**). This appears to be highly magnetic modern material or geological variations at first, however the trend is mirrored in the Earth Resistance data as anomaly **R21** and therefore could have an archaeological origin.

6.45 To the south of this anomaly, an area of magnetic disturbance can be seen surrounding some curvilinear trends (**D2**). The disturbance is unlike the geological variations seen elsewhere in the dataset and could have an archaeological origin.

6.46 A positive broad linear anomaly runs east-west across the north-west of the dataset and is unusual in its form (**D3**).

6.47 A sub-circular anomaly has been identified in the centre-north of the dataset which is very weak in magnetic signal (**D4**) therefore interpretation is tentative.

6.48 To the south of this, a horseshoe shaped sub-circular shaped anomaly consisting of strongly negative and positive trends has been interpreted as having unclear origins (**D5**), though the anomaly could be geological or natural in origin.

6.49 Further south of this, a curvilinear positive anomaly is visible running east-west across the dataset (**D6**).

6.50 In the southern section of the dataset, a weak broad curvilinear trend runs roughly east-west across the area (**D7**). Though the trend could be geological in origin, the anomaly is isolated and the rest of the dataset is fairly quiet, therefor it could have an archaeological origin.

6.51 To the south-west of this trend, two areas of magnetic disturbance have been observed (**D8** & **D9**). These consist of mixed anomalies of positive and negative values adjacent to where a small mound

consisting of rocks was observed in the field, which could possibly be the remains of a Cairn. However the anomalies are also situated next to a small road and associated embankment which could have influenced the data and the mound has not been confirmed as a known feature; therefore further investigation would be required to ascertain its nature.

Geology

6.52 Two areas of magnetic anomalies most likely relating to geological variations can be seen in the north-east of the survey area (**D10**). However the variations are located to the south of an area of magnetic disturbance of an unclear origin and it is possible that these anomalies could be related.

Non-Archaeology

6.53 A strong positive linear trend surrounded by a broad area of magnetic disturbance runs through the centre of the dataset roughly north-north-east to south-south-west (**D11**) and is most likely related to a possible modern service.

6.54 Magnetic disturbance is also seen around the field extents and is most likely related to modern boundary fencing and gateways, as well as modern debris around the field edges.

6.55 Iron spikes can also be seen throughout the dataset for Area 4.

Earth Resistance Survey Results

Area 2

6.56 Three areas within Area 2 were selected for a concentrated Earth Resistance survey.

6.57 In the south of the dataset in Area 2.1, a small area of what appeared to be geological anomalies adjacent to some unknown curvilinear trends (**B7**) were studied to ascertain their origins. The earth resistance results displayed an oval enclosure shaped anomaly, consisting of a series of high (**R1**) and low (**R2**) resistance curvilinear trends. The outer curvilinear trends in particular correlate with the unclear discrete trends seen in the magnetometer data (**B7**). The apparent enclosure could be archaeological in origin, however it could also be geological – representing the remains of a pond.

6.58 The anomalies are fractured in places, which may be as a result of disturbance from trees, as several possible tree bowls are visible in the dataset as oval low resistance anomalies (**R3**). Alternatively these could be features associated with the possible enclosure. Agricultural trends are also visible in the north of this dataset as linear high resistance trends (**R4**). A low resistance anomaly in the south-east of this dataset (**R5**) is also visible as a positive amorphous trend in the magnetometer data and could be archaeological in origin.

6.59 In the north-west of Area 2.2, a set of parallel linear high to very high resistance and low resistance trends run south-west across the dataset (**R6**). The low resistance anomaly in particular corresponds to a linear anomaly of unclear origins observed in the magnetometer data (**B4**) and represents the trackway observed in the field at the time of survey. It is not clear if this is a historical trackway or if it has modern origins.

6.60 A discrete rectilinear high resistance anomaly can be seen in the centre of Area 2.2 and could relate to an enclosure of archaeological origins (**R7**). However the trend could also relate to geological variations, as trends to the south of this (**R8**) coincide with an area of geology observed in the magnetometer data (**B12**). Trends in the north-east of this area also most likely relate to geological variations (**R9**).

6.61 In Area 2.3 the earth resistance results showed no clear anomalies of a possible archaeological origin. In the centre of the dataset, low resistance sub-oval anomalies relate to small trees present in the field at the time of survey (**R10**). High resistance anomalies to the west and east of this (**R11** &

R12) most likely relate to geological variations, as the north-west section of the earth resistance grid was deemed unsurveyable due to a steep slope. The mottled effect of the earth resistance results for this particular area most likely relate to tree bowls from historical tree cover.

Area 3

6.62 Two areas were selected for a concentrated Earth Resistance survey in Area 3 to understand the nature of features observed in the magnetometer data.

6.63 In Area 3.1, a series of parallel low resistance trends are visible running north-south through the dataset (**R13**) which relate to ridges and ruts visible in the field at the time of survey, which are most likely agricultural in origin. A sub-circular high resistance anomaly in the east of the dataset could be archaeological in origin (**R14**) though due to the waterlogged conditions of this part of the field, it could also relate to geological variations. Similarly in the north of the survey area, a very high resistance anomaly (**R15**) most likely relates to waterlogging in the survey area.

6.64 In Area 3.2, weak high and low resistance readings most likely relate to geological variations reflected in the magnetometer survey results (**R16** & **R17**) and agricultural trends as seen further north in Area 3 (**R18**). However as the geological responses are particularly high in this area, they could be masking any archaeological remains present. In the north of the dataset, a very high resistance response relates to a modern holding pond present in the survey area and could relate to waterlogging or modern construction materials (**R19**). In the south of the dataset, a very high resistance anomaly with a low resistance halo relates to the base of a large hill which could have archaeological origins (**R20**).

Area 4

6.65 Two areas were selected for a concentrated Earth Resistance survey in Area 4 due to an anomaly of an uncertain origin identified in the north of the survey area as well as an area of magnetic disturbance of an unclear origin.

6.66 In the north of Area 4.1, a rectilinear area of high resistance around an area of low resistance is visible in the dataset (**R21**). This is mirrored in the magnetometer data as a mixed anomaly of positive and negative anomalies (**D1**). It is suggested that this anomaly is archaeological in origin, however it is difficult to interpret due to its unusual form.

6.67 A similar area of high resistance is visible further south of this (**R22**) which is mirrored in the magnetometer results as an area of magnetic disturbance of an unclear origin (**D2**). It is not known if this is archaeological in origin or relates to more natural geological variations.

6.68 Low resistance and high resistance trends running north-west to south-east across the dataset (**R23**) are also mirrored in the magnetometer data as unclear trends (**D2**) and again it is unclear if these are archaeological in origin.

6.69 The dataset for Area 4.2 is somewhat unusual and contains a number of high and low resistance oval anomalies, creating a ‘mottled’ effect in the data (e.g. **R24**). It is suggested that these anomalies are treebowls and the effect seen here is the pits left from deforestation of the area, possibly for the construction of the adjacent A9.

6.70 In the south of the dataset, a very high resistance anomaly adjacent to smaller low resistance anomalies (**R25**) most likely relates to natural geological outcropping and waterlogging, as observed in the field at the time of survey.

7 Conclusion

7.1 The gradiometer and earth resistance surveys have not identified any anomalies or features of a definitive archaeological nature.

7.2 Curvilinear, rectilinear and amorphous trends have been identified in Areas 2, 3 and 4 that have been classed as having unclear origins, but possibly have archaeological origins and could represent enclosures. The earth resistance surveys mirrored these particular trends identified through the magnetometer data, lending weight to the possibility of them being of an archaeological origin.

7.3 Similar trends of an unclear origin are visible across all four areas that most likely relate to geological or agricultural variations, rather than having archaeological origins.

7.4 Strong geological variations can be seen across most of the survey areas which could mask any archaeological trends present in the survey areas.

7.5 A couple of possible modern services were also detected in the datasets as well as a number of areas of modern magnetic disturbance and ferrous spikes.

8 Statement of Indemnity

8.1 Although the results and interpretation detailed in this report have been produced as accurately as possible, it should be noted that the conclusions offered are a subjective assessment of collected data sets.

8.2 The success of a geophysical survey in identifying archaeological remains can be heavily influenced by several factors, including geology, seasonality, field conditions and the properties of the features being detected. Therefore the geophysical interpretation may only reveal certain archaeological features and not produce a complete plan of all of the archaeological remains within a survey area.

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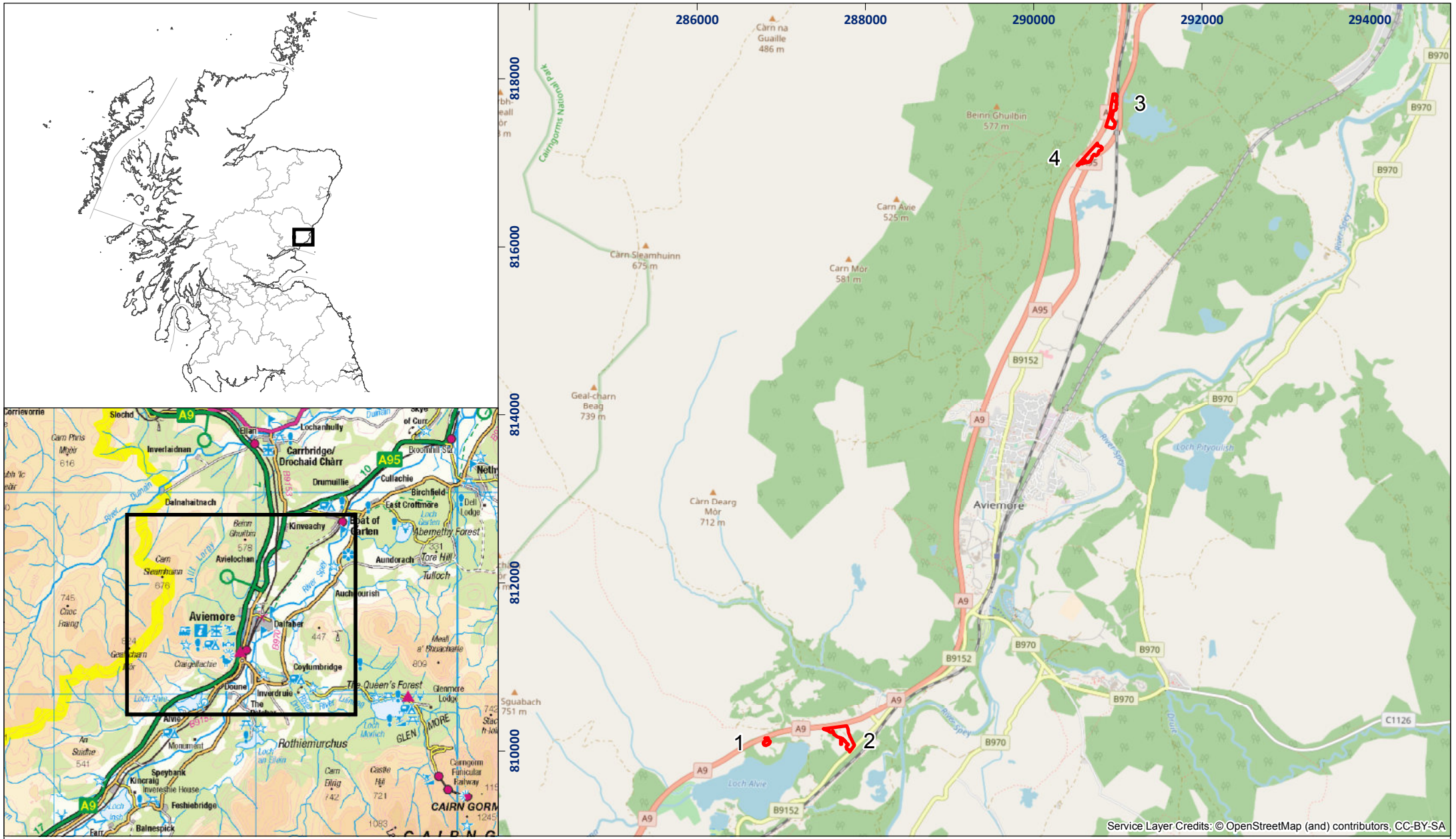
Plate 1. Survey Area 1 looking west

Plate 2. Survey Area 2 looking north-west

Plate 3. Survey Area 3 looking south-west towards unsurveyable mound

Plate 4. Survey Area 4 looking north-east



Site Location Plan

Figure 1

Red Line Boundary

1 Area Number

N

0 2,000m

1:60,000 at A4

Project Title: A9 Dualling - Dalraddy to Slochd Project No: 51846		
Drawing Title: Figure 1 - Site Location Plan		
V1/51846/GEO/F1/04.01.18		
Drawn by: GH	Checked by: KT	Approved by: JL
04/01/2018	04/01/2018	04/01/2018

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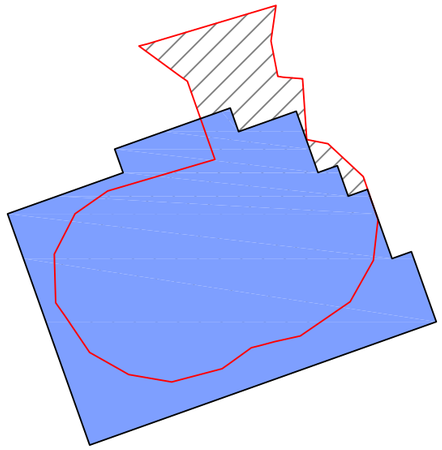
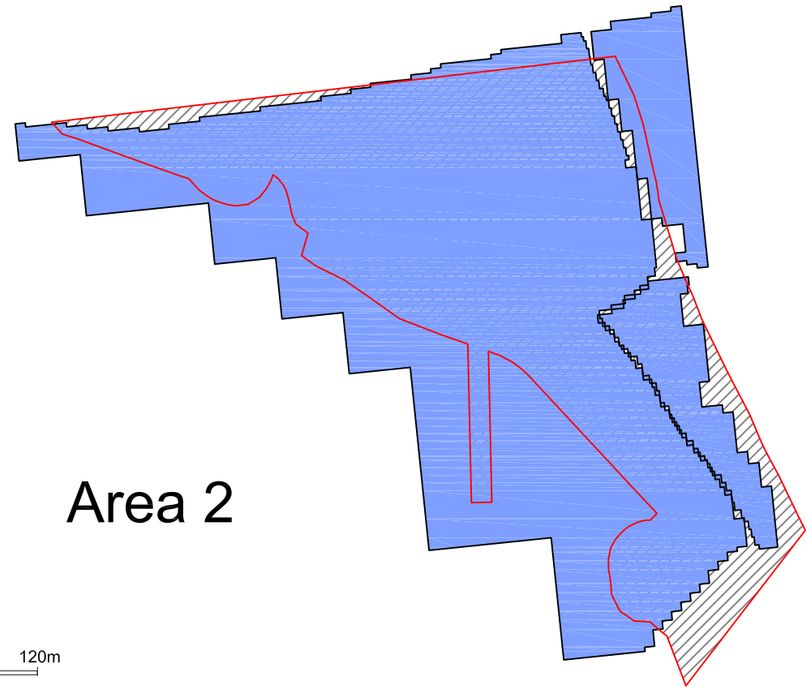
Area 1



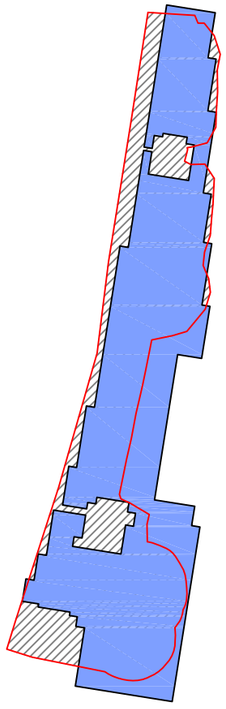
0 60m
1:1500 at A3

Area 2



0 120m
1:3000 at A3

Area 3



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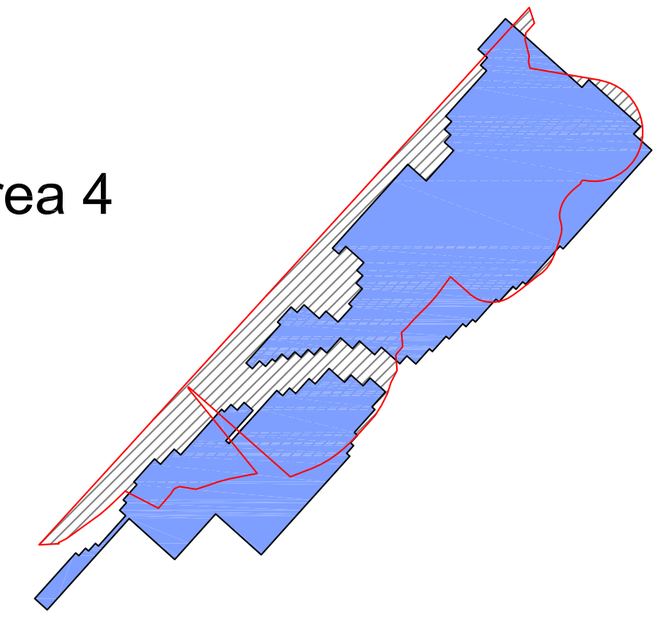
Area 4



0 120m
1:3000 at A3

Location of survey areas

Figure 2

Areas Surveyed
Areas Not Surveyed
Red Line Boundary

N

Project Title: A9 Dualling - Dalraddy to Slochd Project No: 51846		
Drawing Title: Figure 2 - Location of survey areas		
V1/51846/GEO/F2/02.01.18		
Drawn by: KT	Checked by: JL	Approved by: JL
02/01/2018	02/01/2018	02/01/2018

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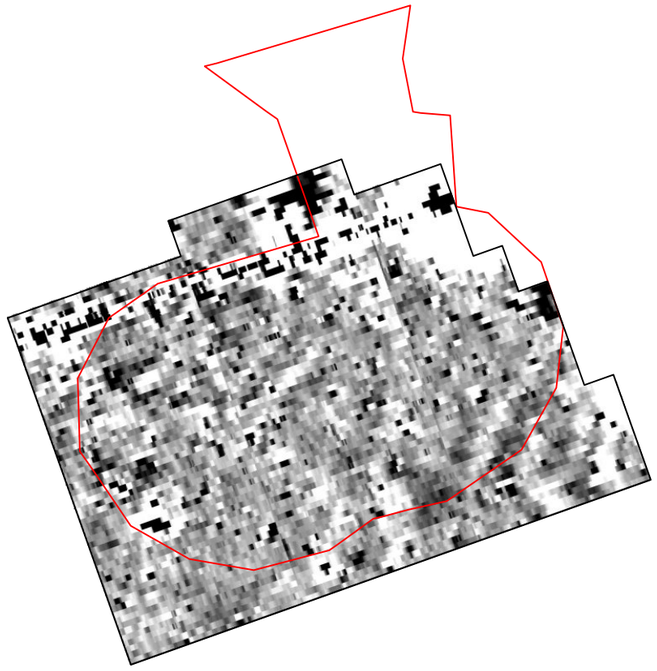
Area 1



Minimally processed Gradiometer survey results - Area 1 - Greyscale plot

Figure 3

Scale
2nT
-1nT

N

0 40m

1:1000 at A3

Project Title: A9 Dualling - Dalraddy to Slochd Project No: 51846		
Drawing Title: Figure 3 - Minimally processed Gradiometer survey results - Area 1 - Greyscale plot		
V1/51846/GEO/F3/03.01.18		
Drawn by: KT	Checked by: JL	Approved by: JL
03/01/2018	03/01/2018	03/01/2018

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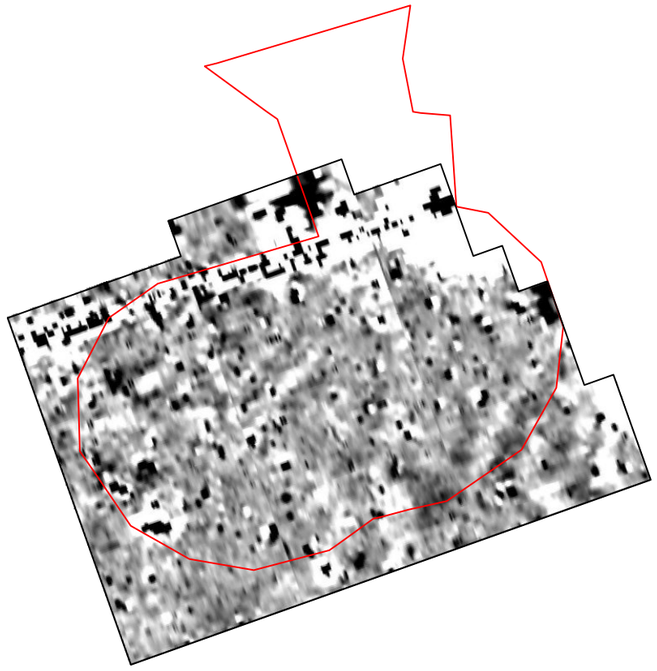
Area 1



Processed Gradiometer survey results - Area 1 - Greyscale plot

Figure 4

Scale
2nT
-1nT

N
0 40m
1:1000 at A3

Project Title: A9 Dualling - Dalraddy to Slochd Project No: 51846		
Drawing Title: Figure 4 - Processed Gradiometer survey results - Area 1 - Greyscale plot		
V1/51846/GEO/F4/03.01.18		
Drawn by: KT	Checked by: JL	Approved by: JL
03/01/2018	03/01/2018	03/01/2018

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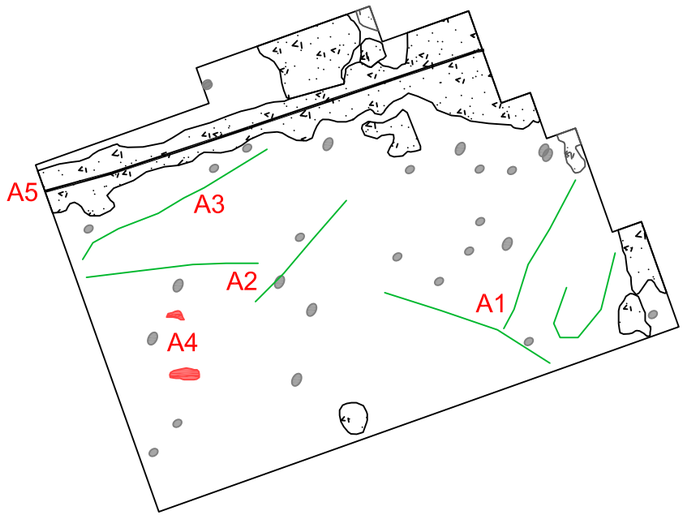
Area 1



Interpretation of Gradiometer survey results - Area 1

Figure 5

- Discrete Pit (Archaeology?)
- Trend (Unclear Origin)
- Linear Trend (Modern Service)
- Area of Disturbance (Modern)
- Ferrous / Iron Spikes

N

0 40m

1:1000 at A3

Project Title: A9 Dualling - Dalraddy to Slochd Project No: 51846		
Drawing Title: Figure 5 - Interpretation of Gradiometer survey results - Area 1		
V1/51846/GEO/F5/03.01.18		
Drawn by: KT	Checked by: JL	Approved by: JL
03/01/2018	03/01/2018	03/01/2018

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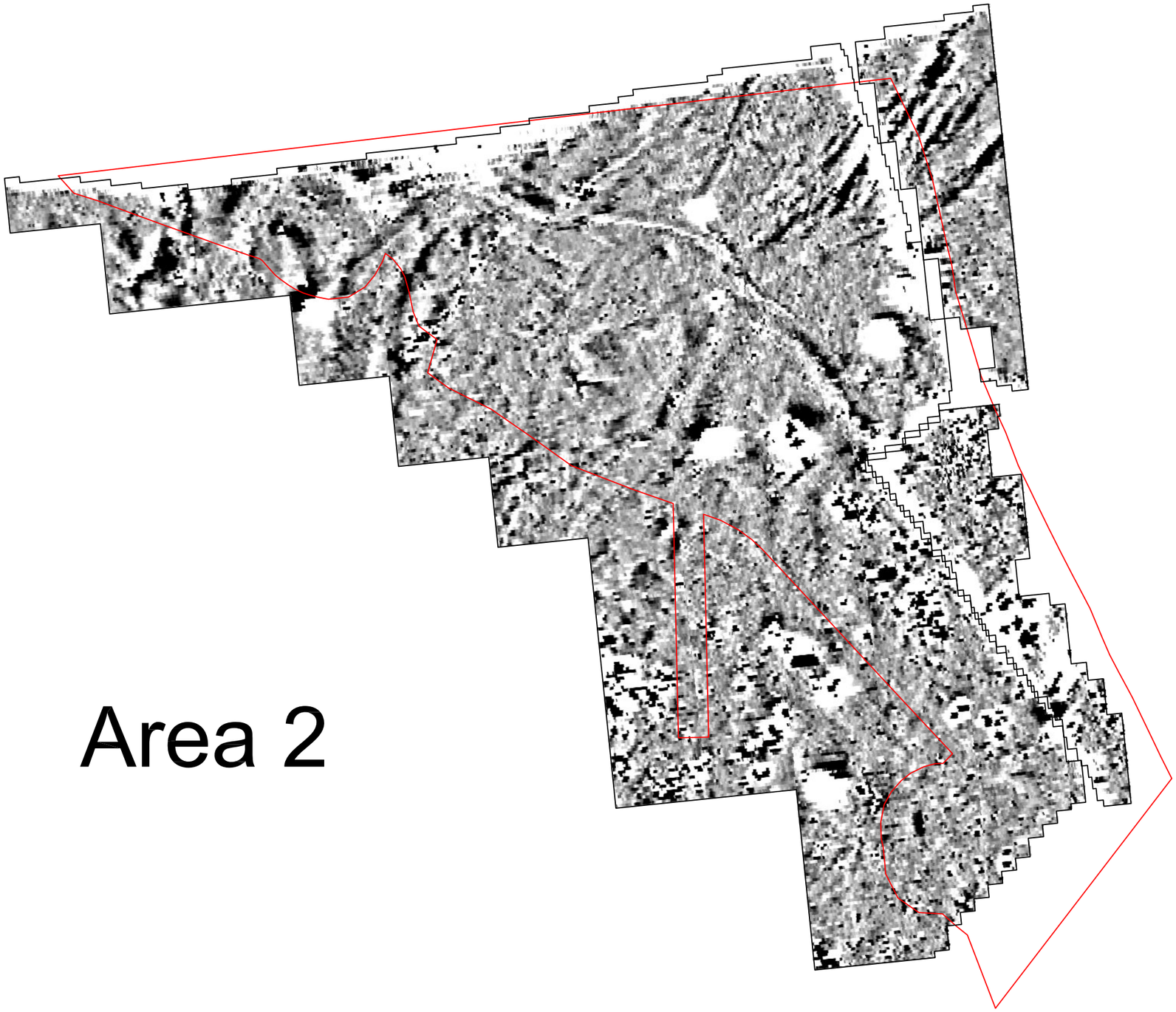

Area 2

Minimally processed Gradiometer survey results - Area 2 - Greyscale plot

Figure 6

Scale
2nT
-1nT

N

0 60m

1:1500 at A3

Project Title: A9 Dualling - Dalraddy to Slochd Project No: 51846		
Drawing Title: Figure 6 - Minimally processed Gradiometer survey results - Area 2 - Greyscale plot		
V1/51846/GEO/F6/03.01.18		
Drawn by: KT	Checked by: JL	Approved by: JL
03/01/2018	03/01/2018	03/01/2018

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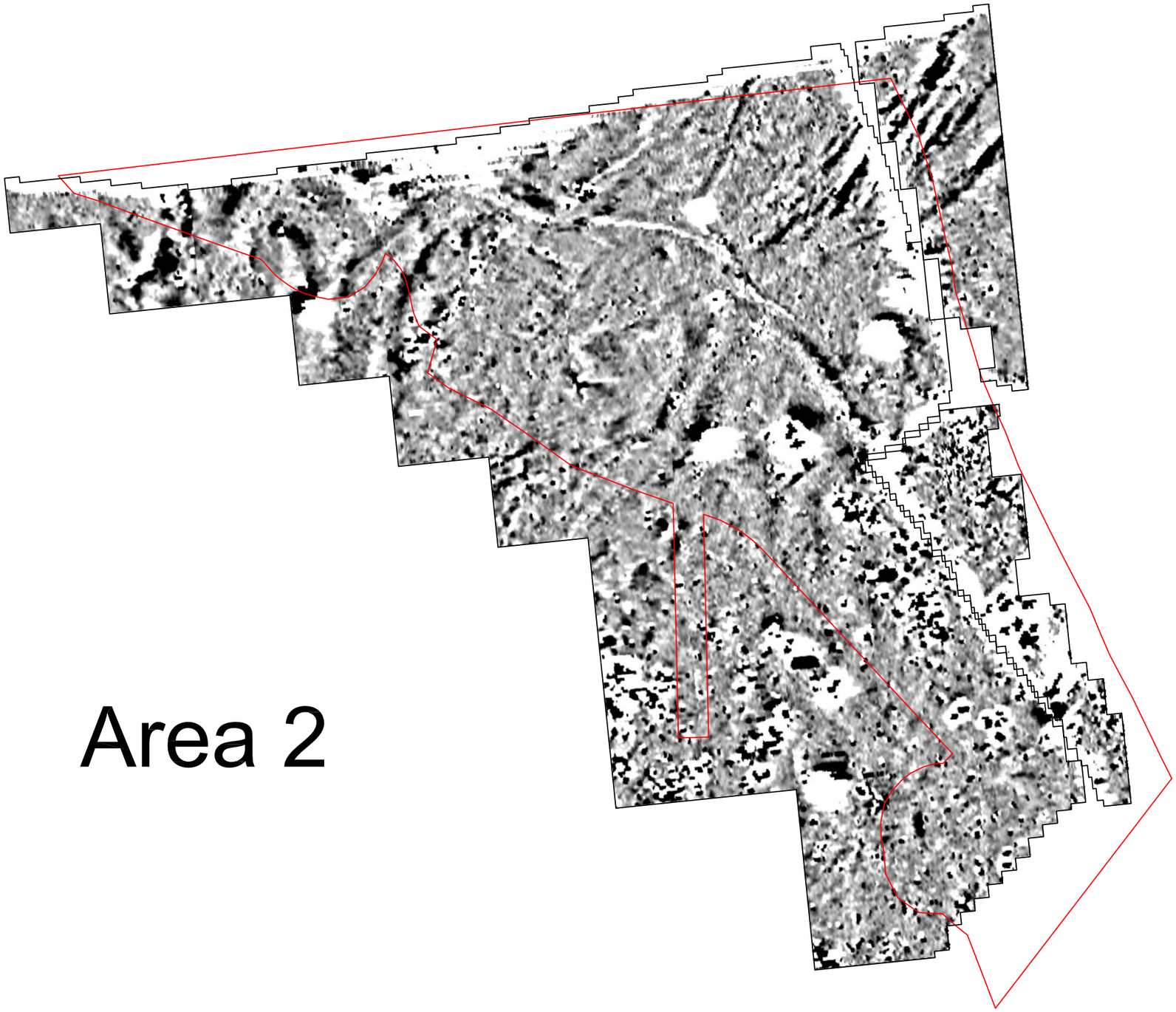

Area 2

Processed Gradiometer survey results - Area 2 - Greyscale plot

Figure 7

Scale
2nT
-1nT

N

0 60m

1:1500 at A3

Project Title: A9 Dualling - Dalraddy to Slochd Project No: 51846		
Drawing Title: Figure 7 - Processed Gradiometer survey results - Area 2 - Greyscale plot		
V1/51846/GEO/F7/03.01.18		
Drawn by: KT	Checked by: JL	Approved by: JL
03/01/2018	03/01/2018	03/01/2018

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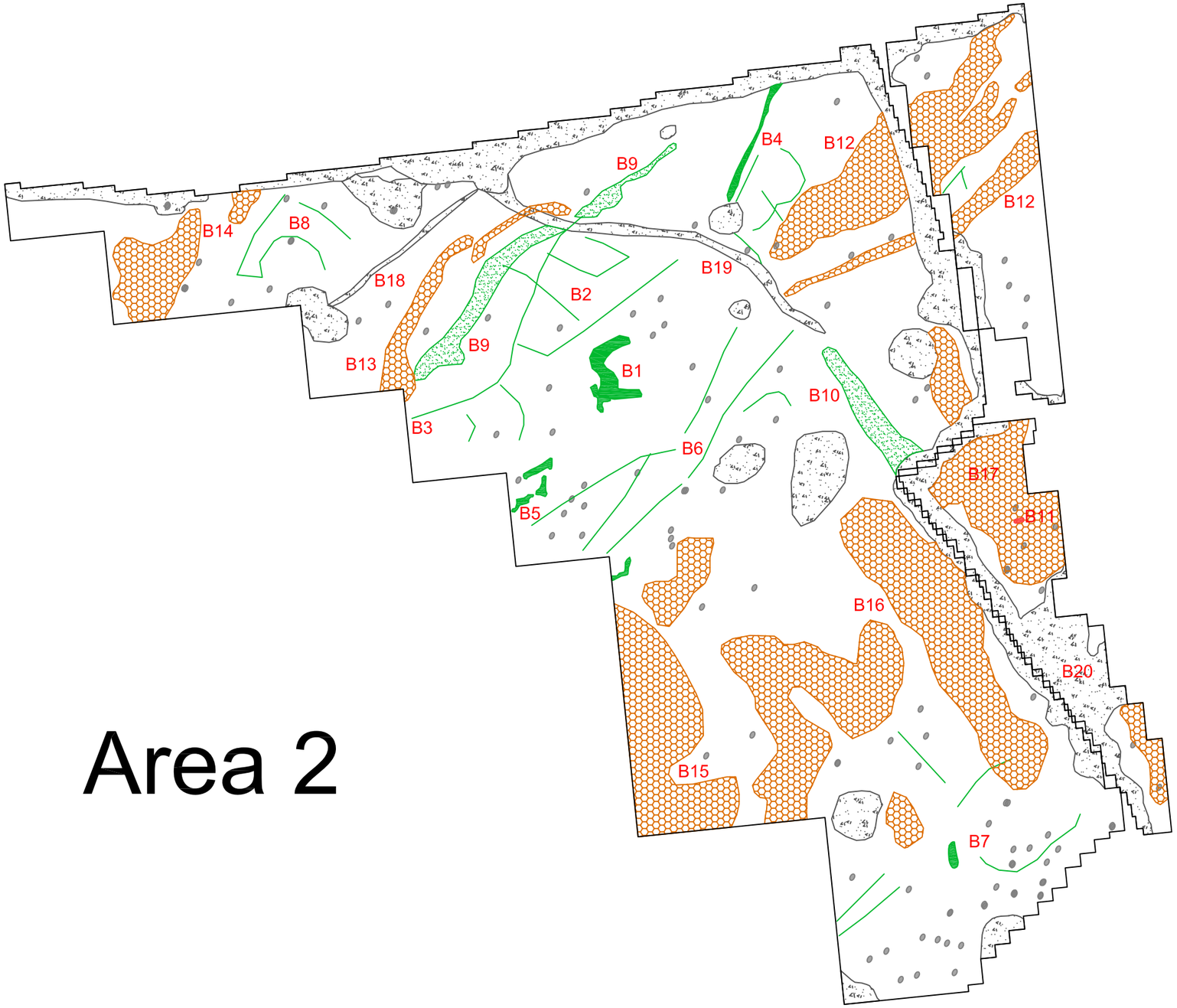

Area 2

Interpretation of Gradiometer survey results - Area 2

Figure 8

- Discrete Pit (Archaeology?)
- Trend (Unclear Origin)
- Area of Disturbance (Unclear Origin)
- Geology / Natural
- Area of Disturbance (Modern)
- Ferrous / Iron Spikes

N

0 60m

1:1500 at A3

Project Title: A9 Dualling - Dalraddy to Slochd Project No: 51846		
Drawing Title: Figure 8 - Interpretation of Gradiometer survey results - Area 2		
V1/51846/GEO/F8/03.01.18		
Drawn by: KT	Checked by: JL	Approved by: JL
03/01/2018	03/01/2018	03/01/2018

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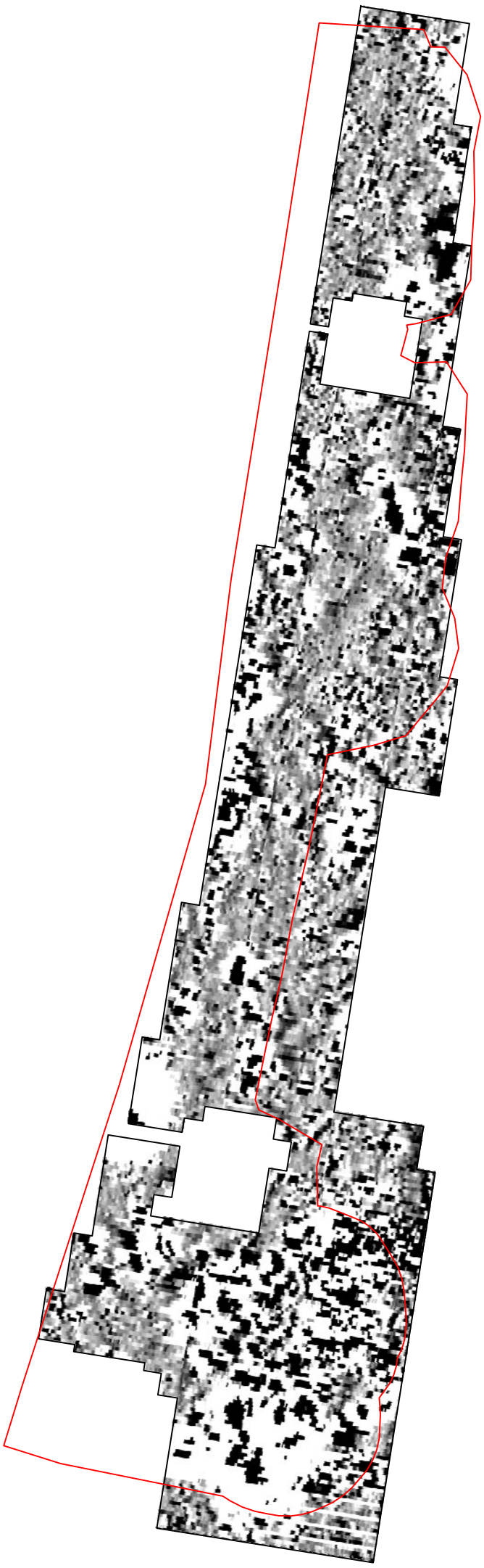
Area 3



Minimally processed Gradiometer survey results - Area 3 - Greyscale plot

N

0 60m

1:1500 at A3

Figure 9

Scale 2nT -1nT

Project Title: A9 Dualling - Dalraddy to Slochd
Project No: 51846

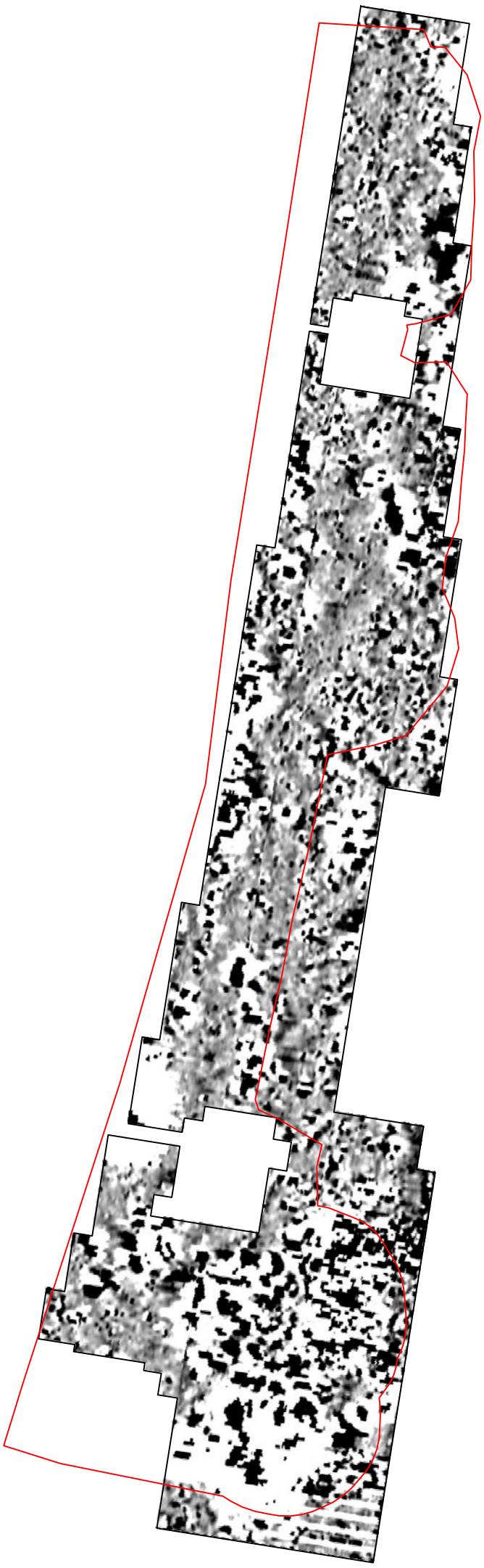
Drawing Title: Figure 9 - Minimally processed Gradiometer survey results - Area 3 - Greyscale plot

V1/51846/GEO/F9/03.01.18

Drawn by: KT	Checked by: JL	Approved by: JL
03/01/2018	03/01/2018	03/01/2018

AOC Archaeology Group

Area 3



Processed Gradiometer survey results - Area 3 - Greyscale plot

N

0 60m

1:1500 at A3

Figure 10

Scale 2nT -1nT

Project Title: A9 Dualling - Dalraddy to Slochd
Project No: 51846

Drawing Title: Figure 10 - Processed Gradiometer survey results - Area 3 - Greyscale plot

V1/51846/GEO/F10/03.01.18

Drawn by: KT	Checked by: JL	Approved by: JL
03/01/2018	03/01/2018	03/01/2018

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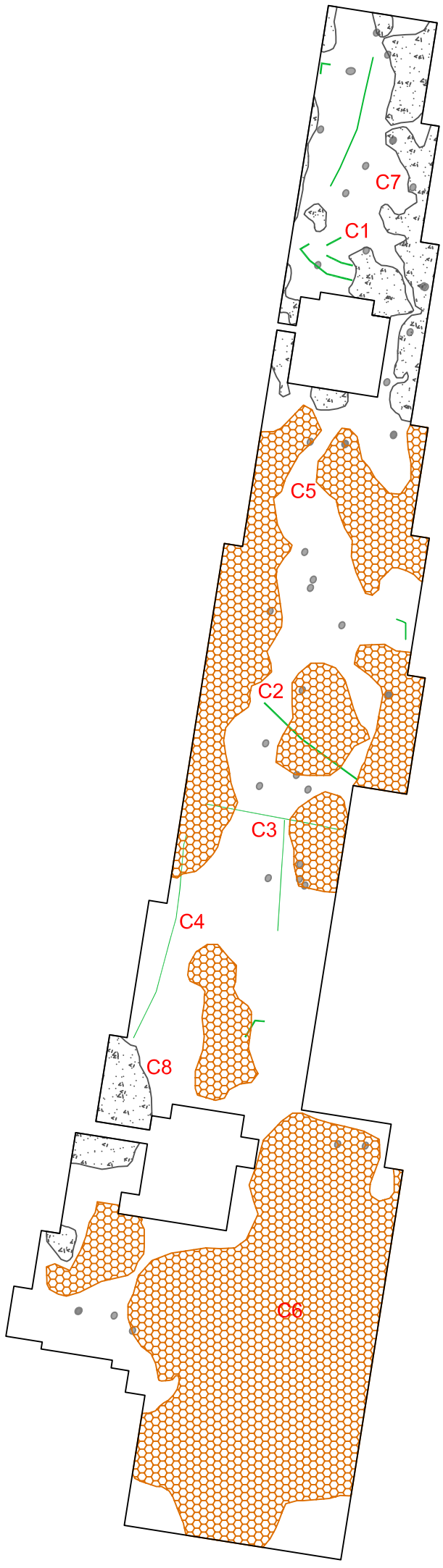
Area 3



Interpretation of Gradiometer survey results - Area 3

N

0 60m

1:1500 at A3

Figure 11

Trend (Unclear Origin)

Geology / Natural

Area of Disturbance (Modern)

Ferrous / Iron Spikes

Project Title: A9 Dualling - Dalraddy to Slochd Project No: 51846	
Drawing Title: Figure 11 - Interpretation of Gradiometer survey results - Area 3	
V1/51846/GEO/F11/03.01.18	
Drawn by: KT	Checked by: JL / 03/01/2018
Approved by: JL / 03/01/2018	

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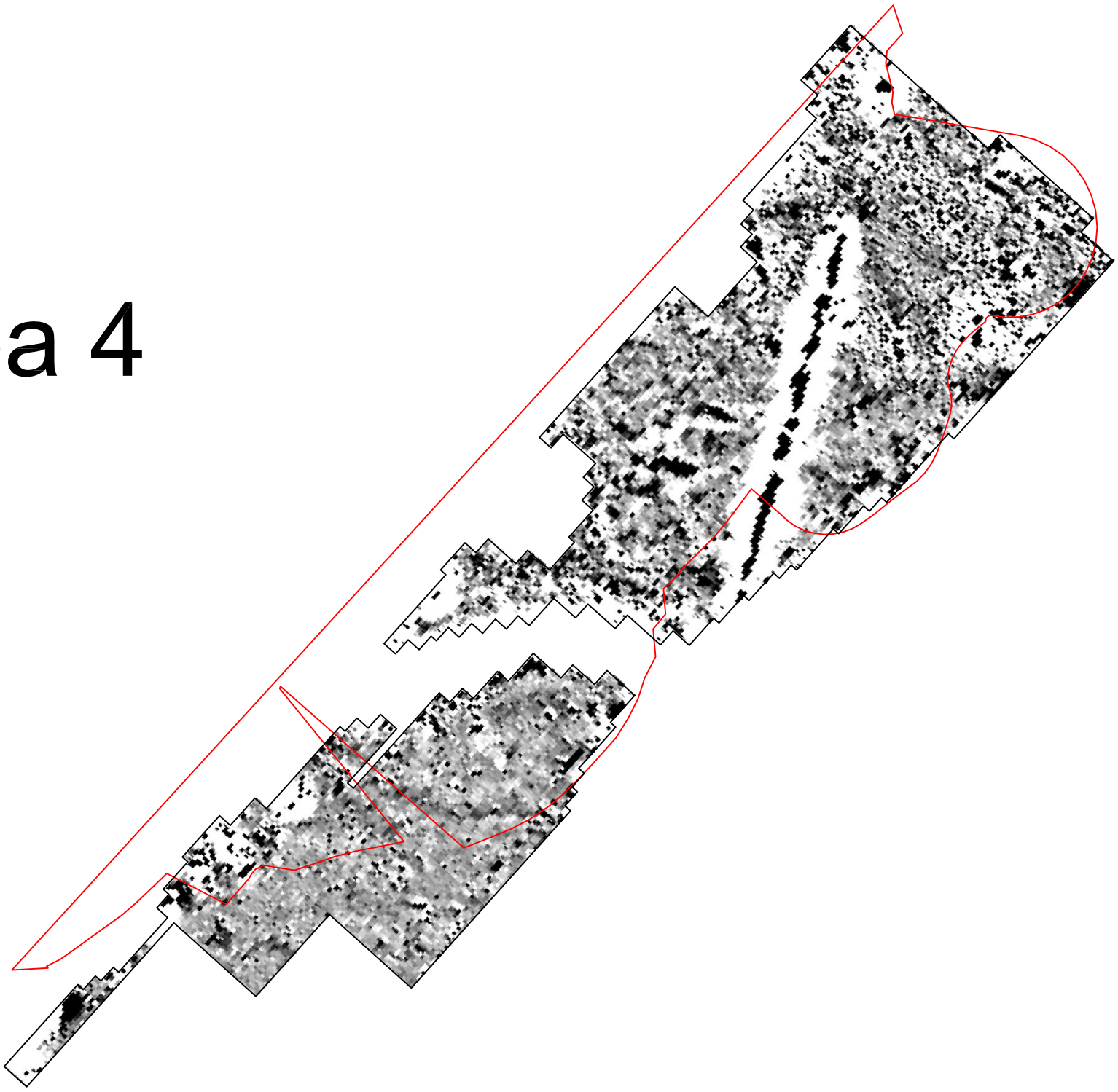
Area 4



Minimally processed Gradiometer survey results - Area 4 - Greyscale plot

N

0 60m

1:1500 at A3

Figure 12

Scale 2nT -1nT

Project Title: A9 Dualling - Dalraddy to Slochd
Project No: 51846

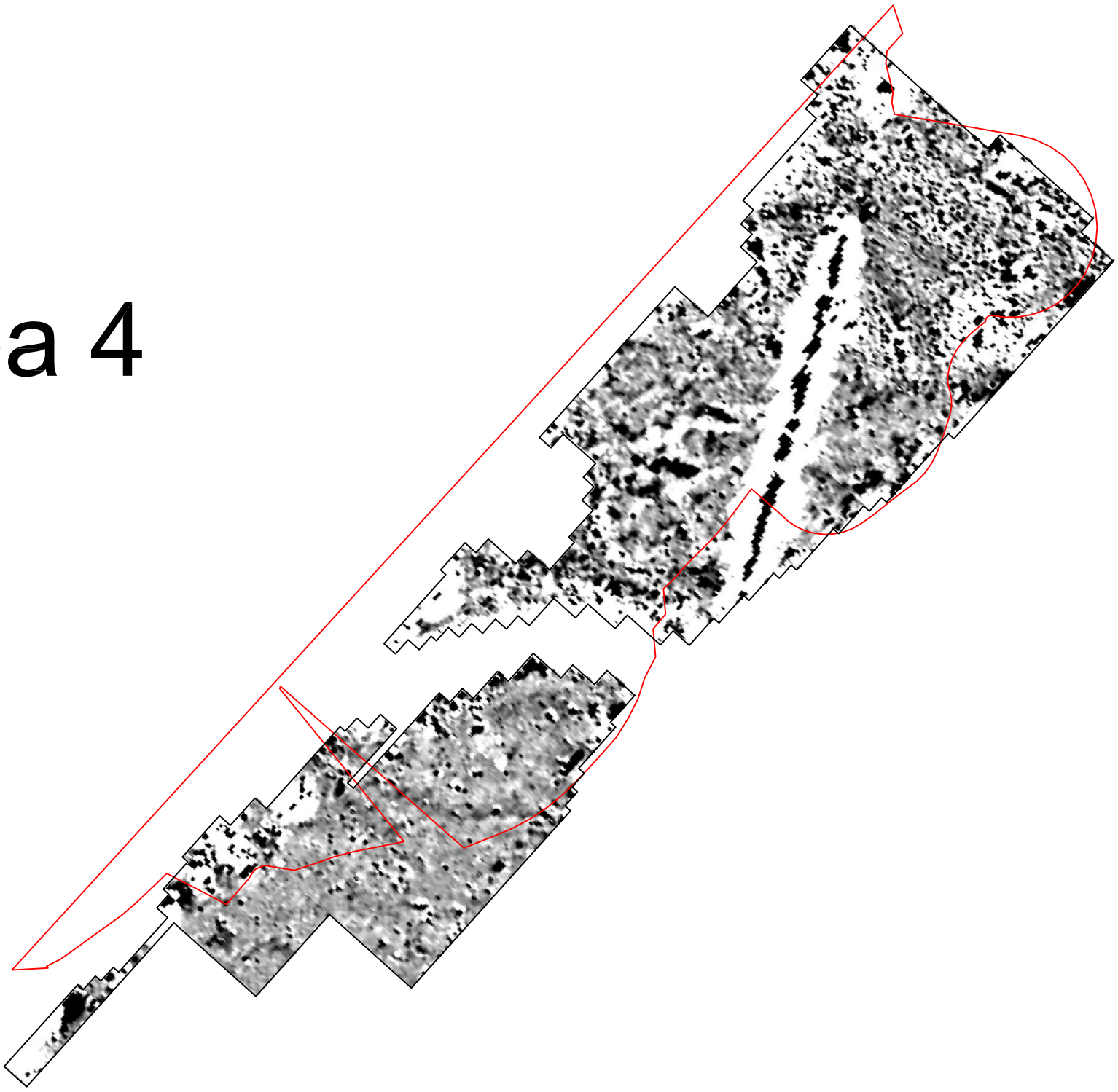
Drawing Title: Figure 12 - Minimally processed Gradiometer survey results - Area 4 - Greyscale plot

V1/51846/GEO/F12/03.01.18

Drawn by: KT	Checked by: JL	Approved by: JL
03/01/2018	03/01/2018	03/01/2018

AOC Archaeology Group

Area 4



Processed Gradiometer survey results - Area 4 - Greyscale plot

N

0 60m

1:1500 at A3

Figure 13

Scale 2nT -1nT

Project Title: A9 Dualling - Dalraddy to Slochd
Project No: 51846

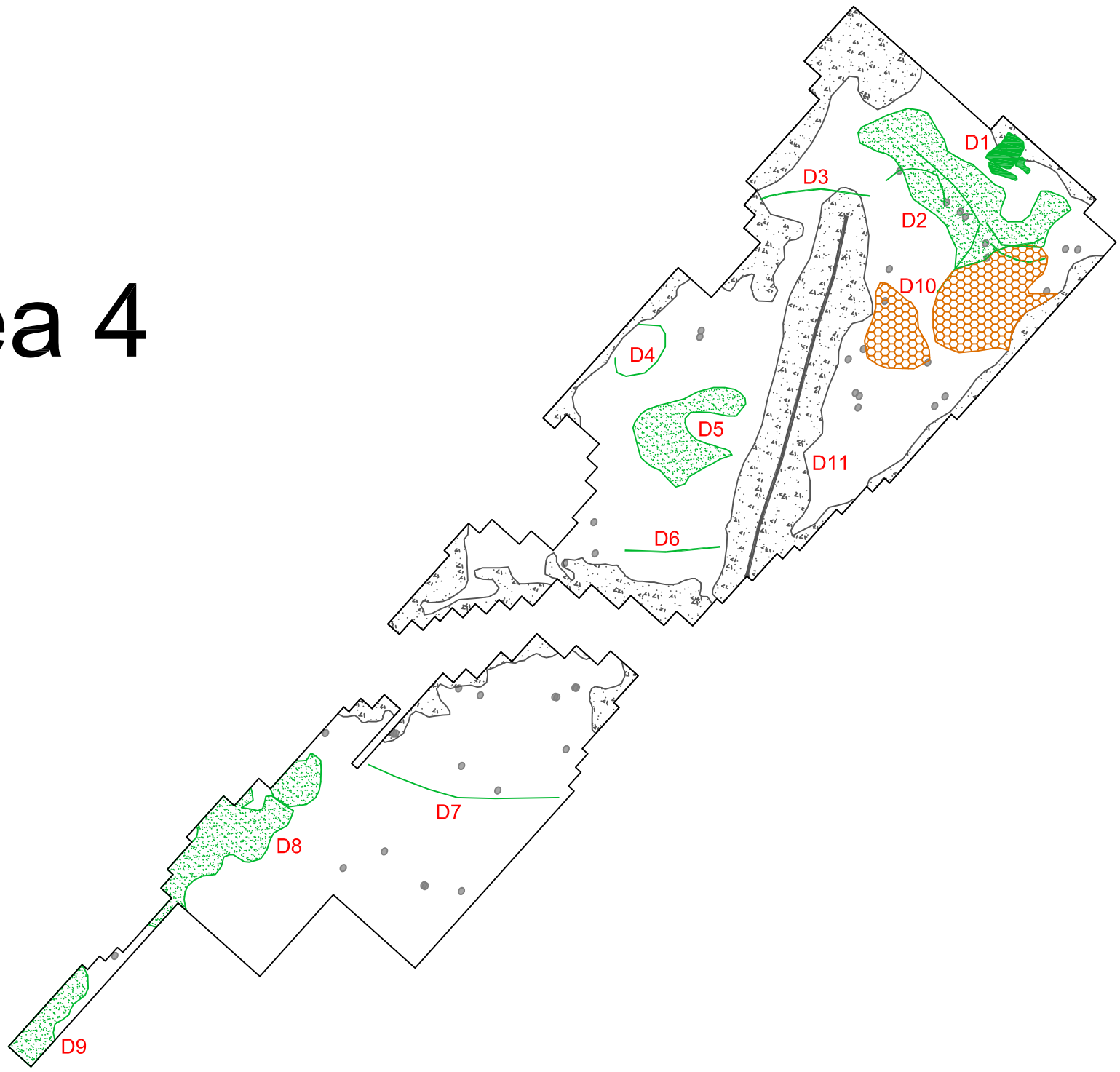
Drawing Title: Figure 13 - Processed Gradiometer survey results - Area 4 - Greyscale plot

V1/51846/GEO/F13/03.01.18

Drawn by: KT	Checked by: JL	Approved by: JL
03/01/2018	03/01/2018	03/01/2018

AOC Archaeology Group

Area 4



Interpretation of Gradiometer survey results - Area 4

N

0 60m

1:1500 at A3

Figure 14

- Trend (Unclear Origin)
- Area of Disturbance (Unclear Origin)
- Geology / Natural
- Linear Trend (Modern Service)
- Area of Disturbance (Modern)
- Ferrous / Iron Spikes

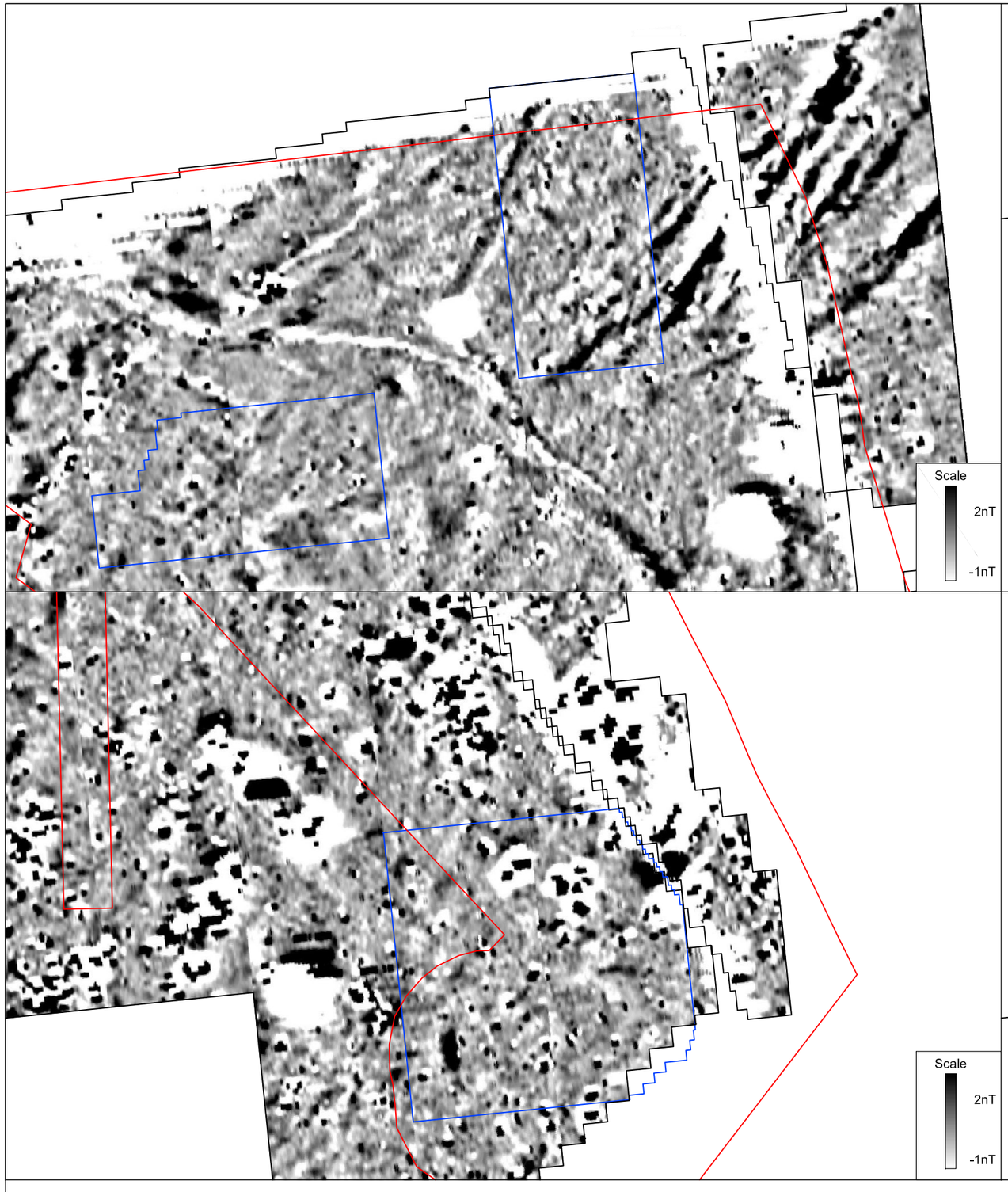
Project Title: A9 Dualling - Dalraddy to Slochd
Project No: 51846

Drawing Title: Figure 14 - Interpretation of Gradiometer survey results - Area 4

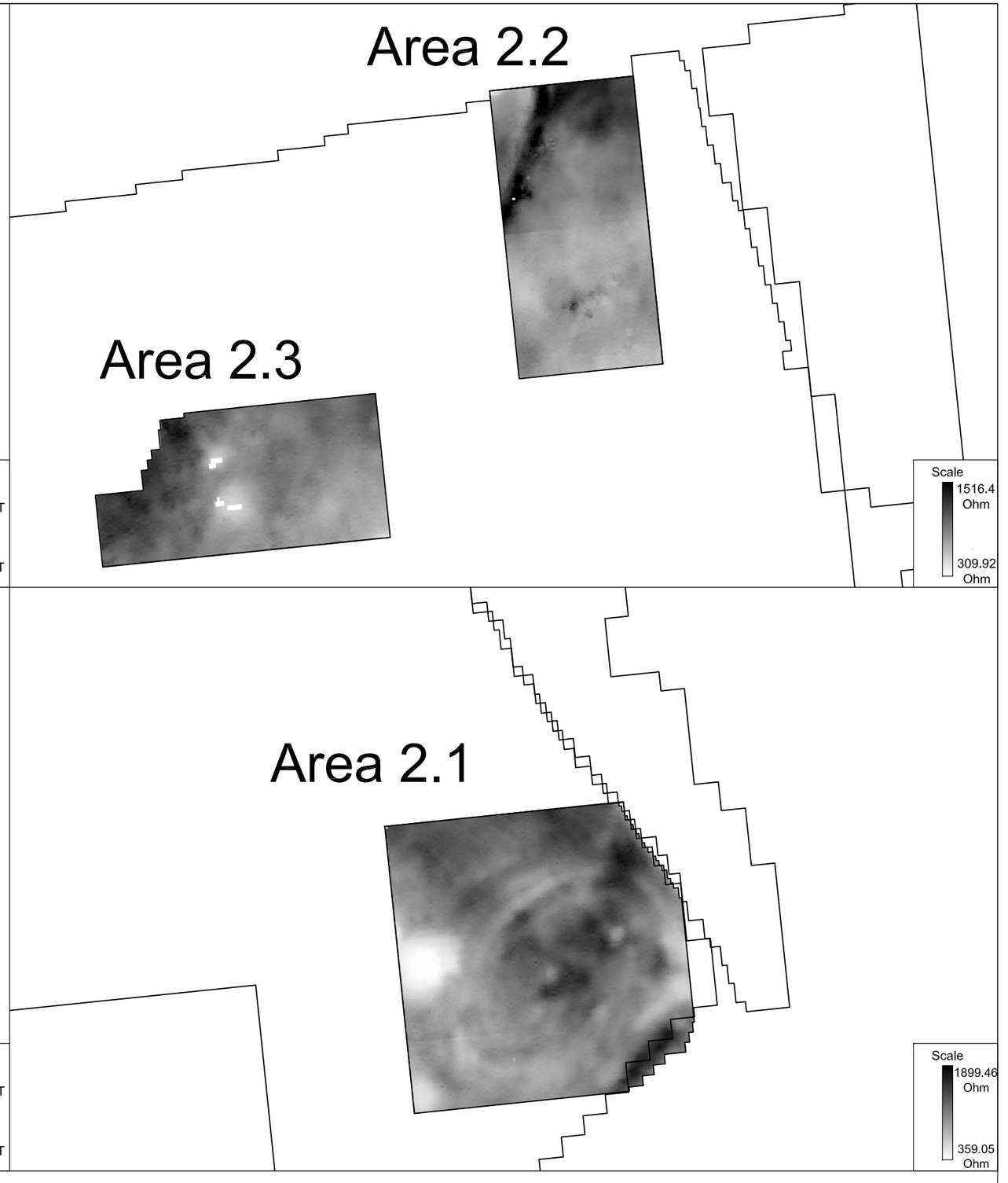
V1/51846/GEO/F14/03.01.18

Drawn by: KT	Checked by: JL	Approved by: JL
03/01/2018	03/01/2018	03/01/2018

AOC Archaeology Group



Processed Gradiometer survey results - Area 2



Minimally processed Earth Resistance survey results - Area 2

Figure 15

Area selected for Earth Resistance survey

Red Line Boundary

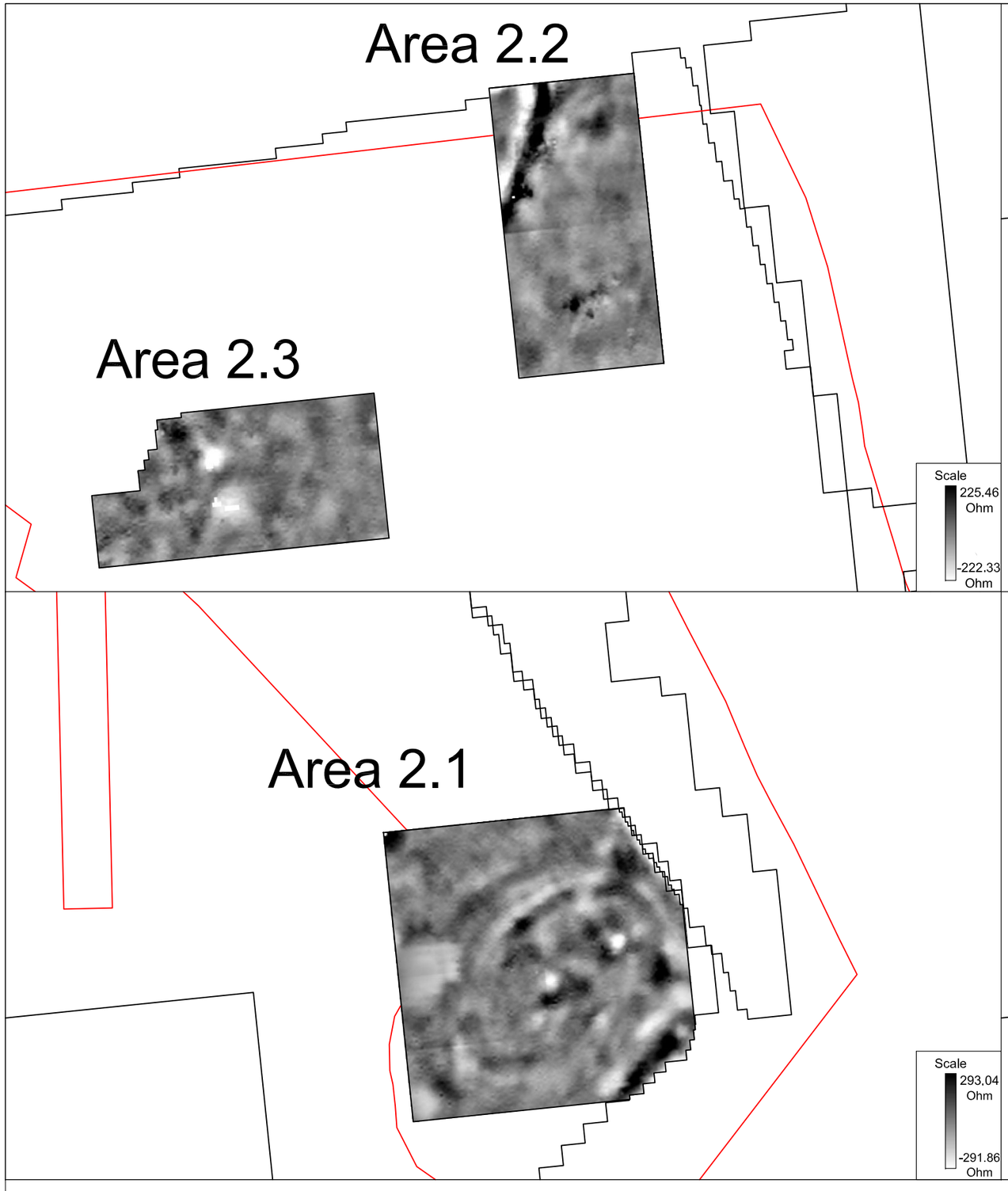
N

0 40m

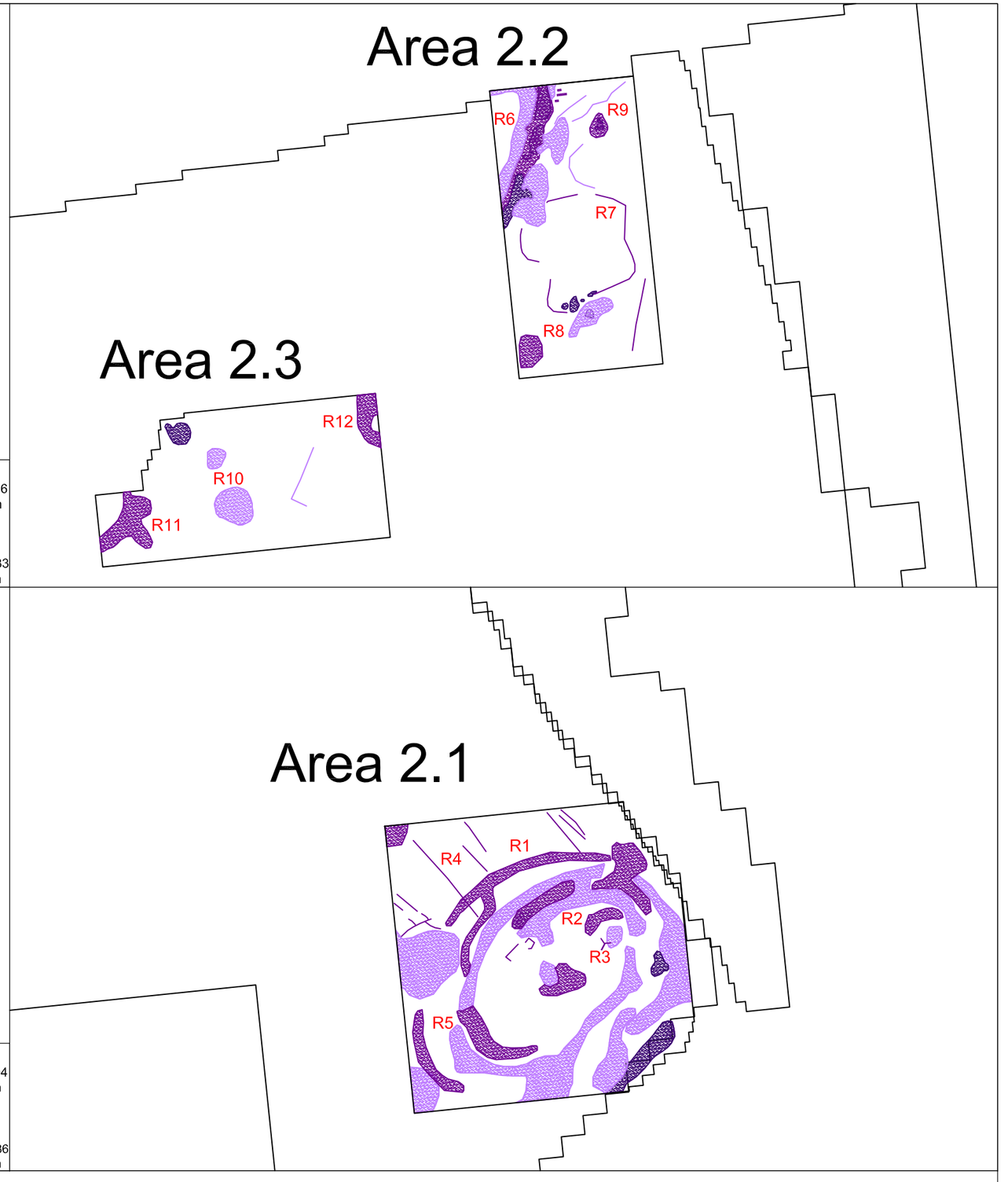
1:1000 at A3

Project Title: A9 Dualling - Dalraddy to Slochd		
Project No: 51846		
Drawing Title: Figure 15 - Processed Gradiometer survey results & Minimally processed Earth Resistance survey results - Area 2		
V1/51846/GEO/F15/03.01.18		
Drawn by: KT	Checked by: JL	Approved by: JL
03/01/2018	03/01/2018	03/01/2018

AOC Archaeology Group



Processed Earth Resistance survey results - Area 2



Interpretation of Earth Resistance survey results - Area 2

Figure 16

Red Line Boundary

Low Resistance

High Resistance

Very High Resistance

N

0 40m

1:1000 at A3

Project Title: A9 Dualling - Dalraddy to Slochd		
Project No: 51846		
Drawing Title: Figure 16 - Processed Earth Resistance survey results & Interpretation of Earth Resistance survey results - Area 2		
V1/51846/GEO/F16/05.01.18		
Drawn by: KT	Checked by: JL	Approved by: JL
05/01/2018	05/01/2018	05/01/2018

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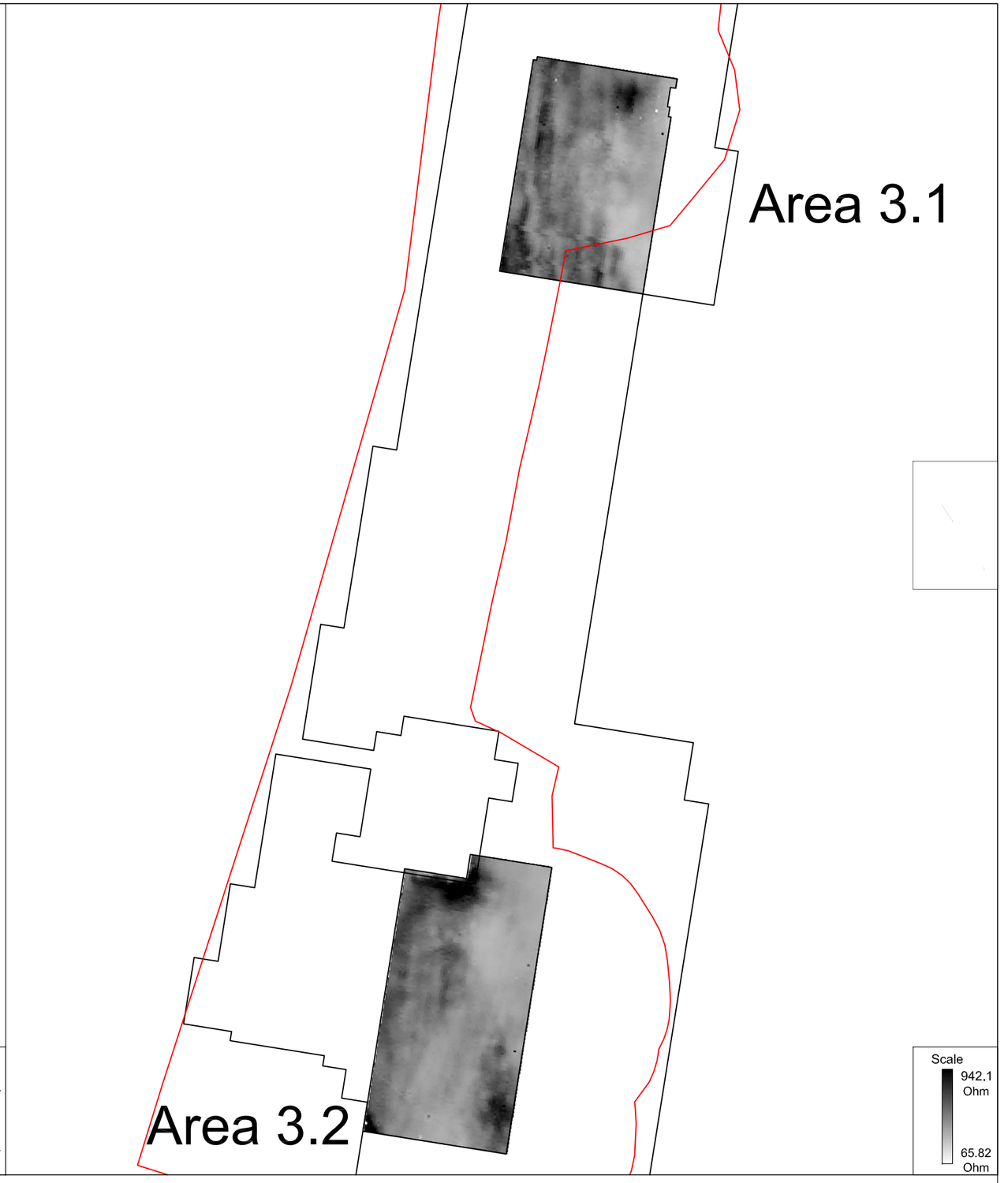
Processed Gradiometer survey results - Area 3



Minimally processed Earth Resistance survey results - Area 3

Figure 15

Area selected for Earth Resistance survey

Red Line Boundary

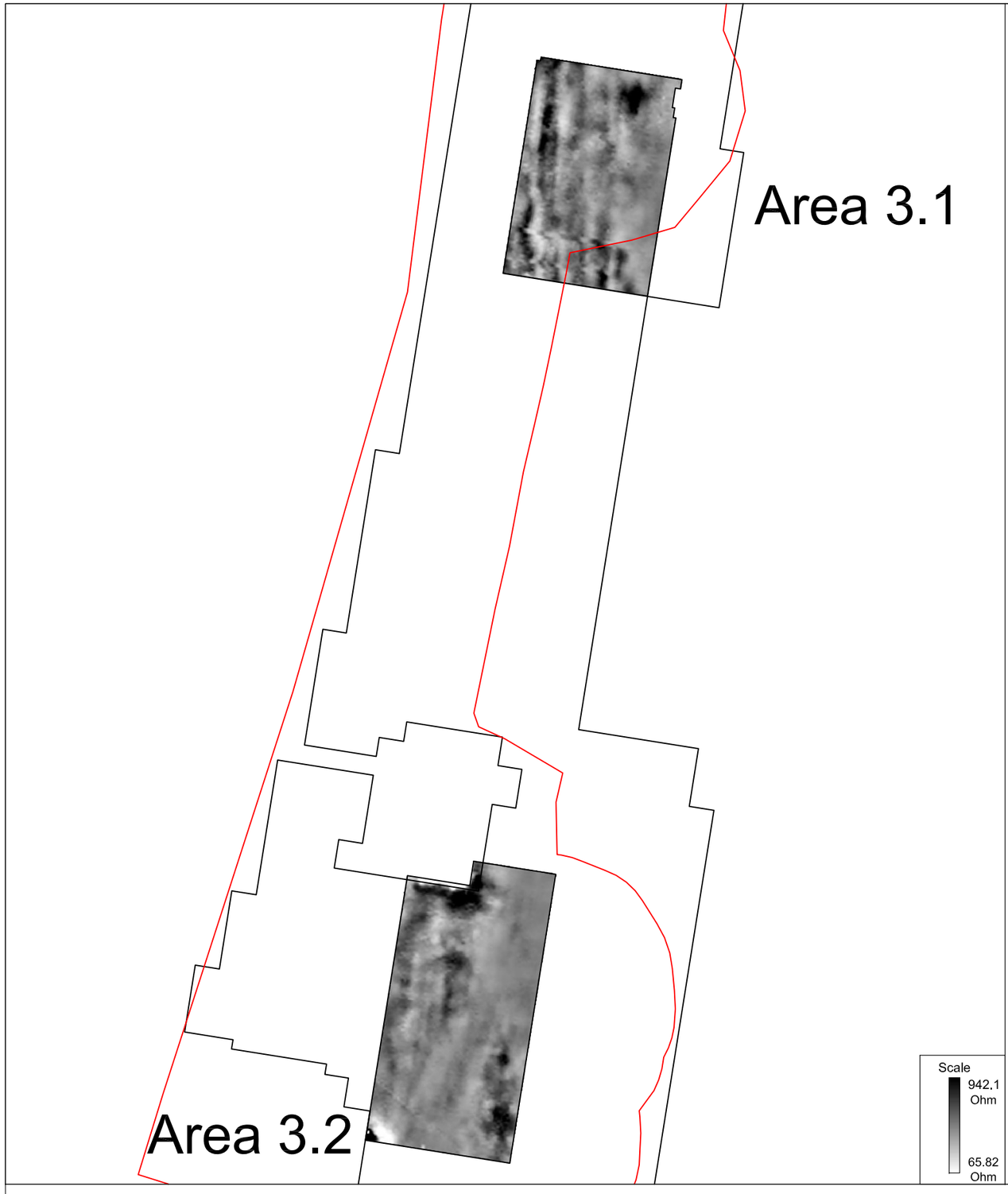
N

0 40m

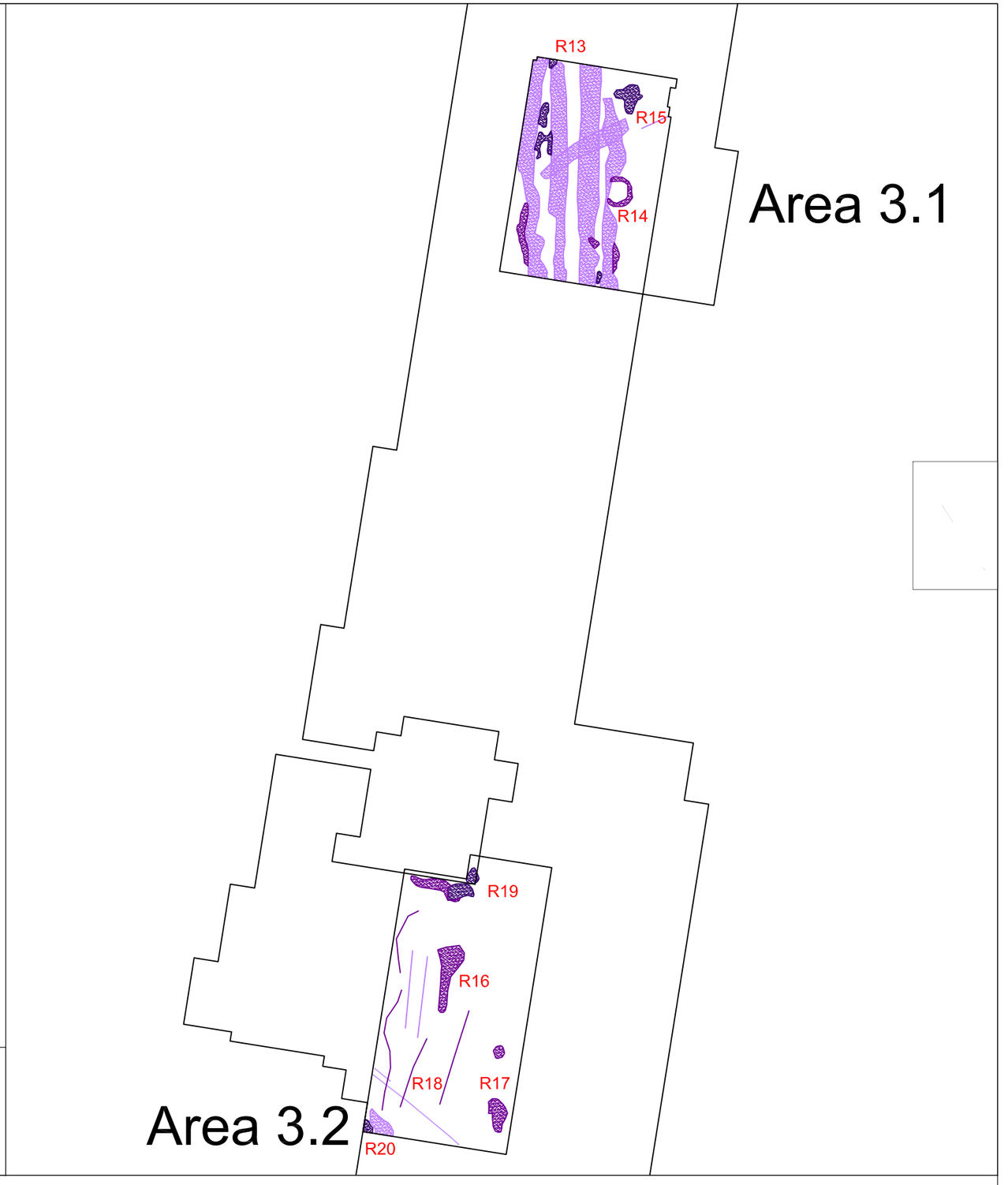
1:1000 at A3

Project Title: A9 Dualling - Dalraddy to Slochd		
Project No: 51846		
Drawing Title: Figure 17 - Processed Gradiometer survey results & Minimally processed Earth Resistance survey results - Area 3		
V1/51846/GEO/F17/03.01.18		
Drawn by: KT	Checked by: JL	Approved by: JL
03/01/2018	03/01/2018	03/01/2018

AOC Archaeology Group



Processed Earth Resistance survey results - Area 3



Interpretation of Earth Resistance survey results - Area 3

Figure 18

Red Line Boundary

Low Resistance

High Resistance

Very High Resistance

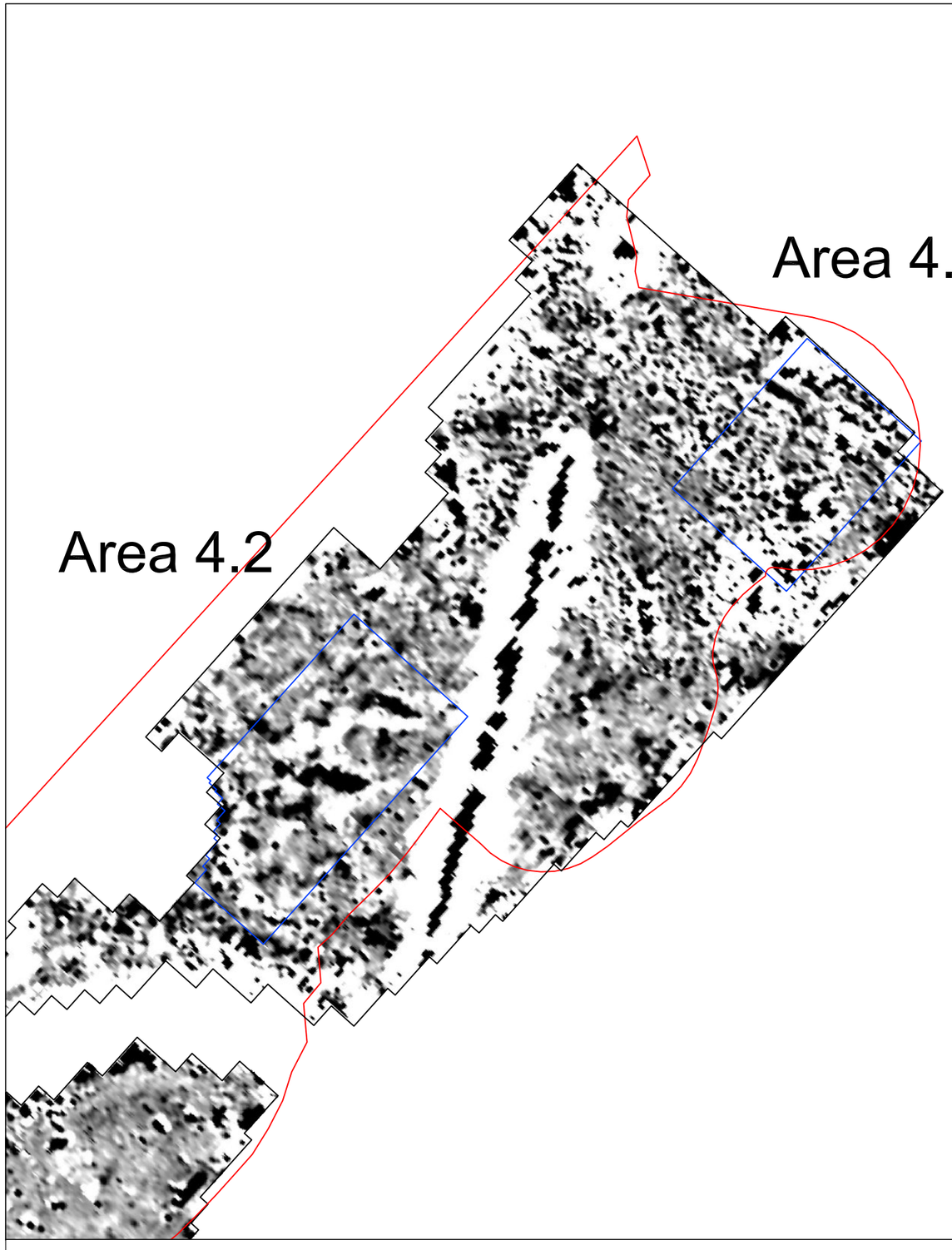
N

0 40m

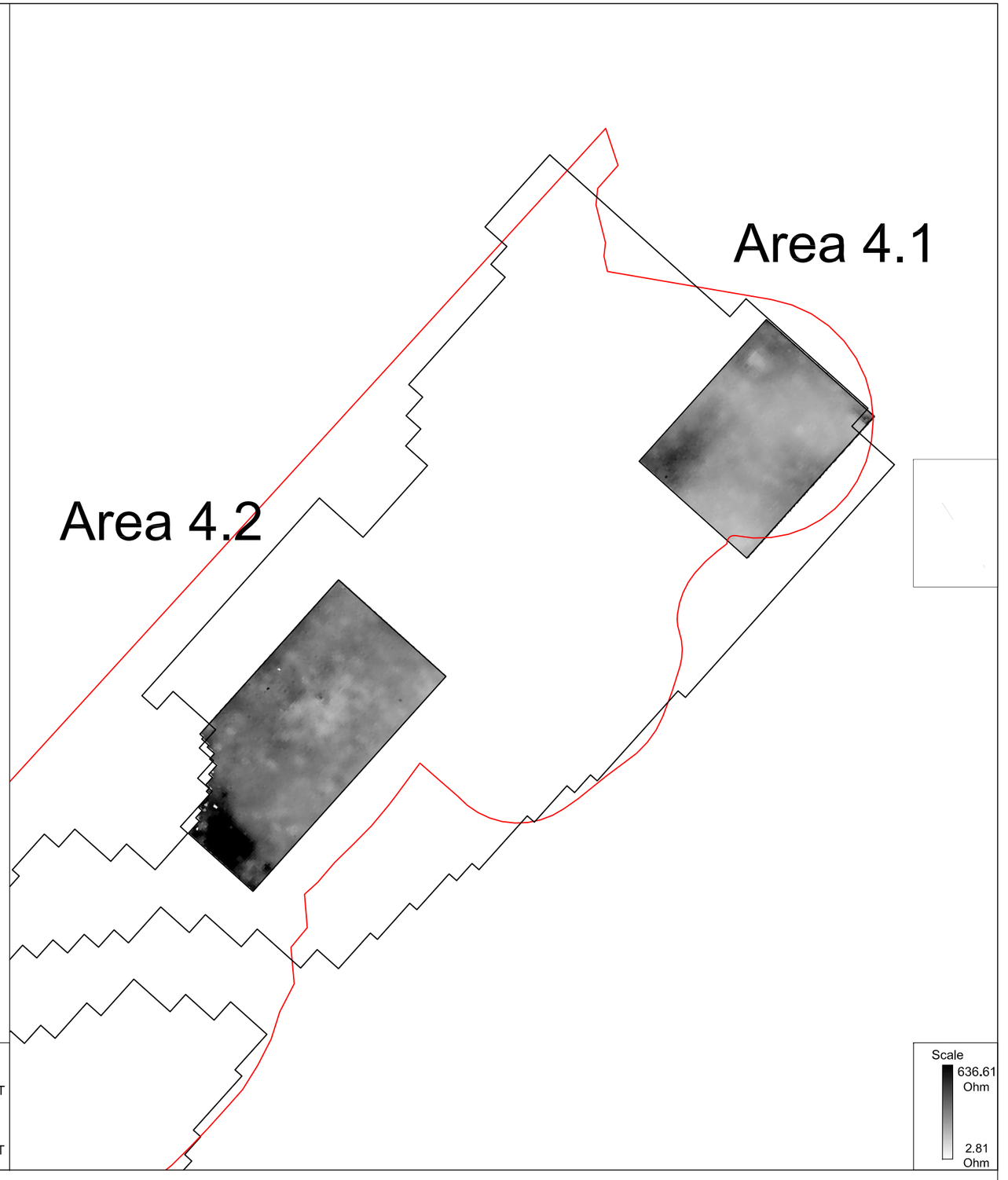
1:1000 at A3

Project Title: A9 Dualling - Dalraddy to Slochd Project No: 51846		
Drawing Title: Figure 17 - Processed Earth Resistance survey results & Interpretation of Earth Resistance survey results - Area 3		
V1/51846/GEO/F18/05.01.18		
Drawn by: KT	Checked by: JL	Approved by: JL
05/01/2018	05/01/2018	05/01/2018

AOC Archaeology Group



Processed Gradiometer survey results - Area 4



Minimally processed Earth Resistance survey results - Area 4

Figure 19

Area selected for Earth Resistance survey

Red Line Boundary

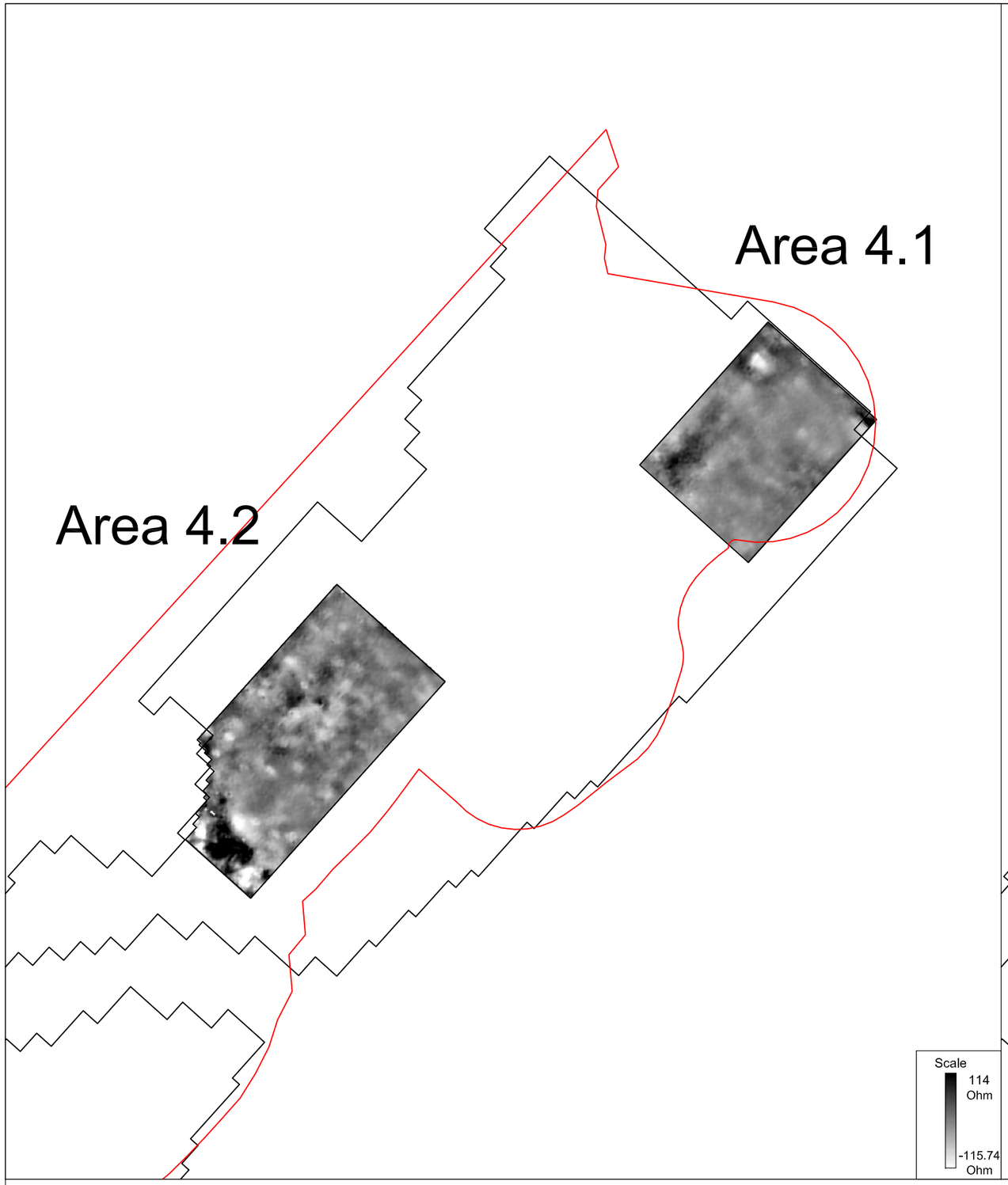
N

0 40m

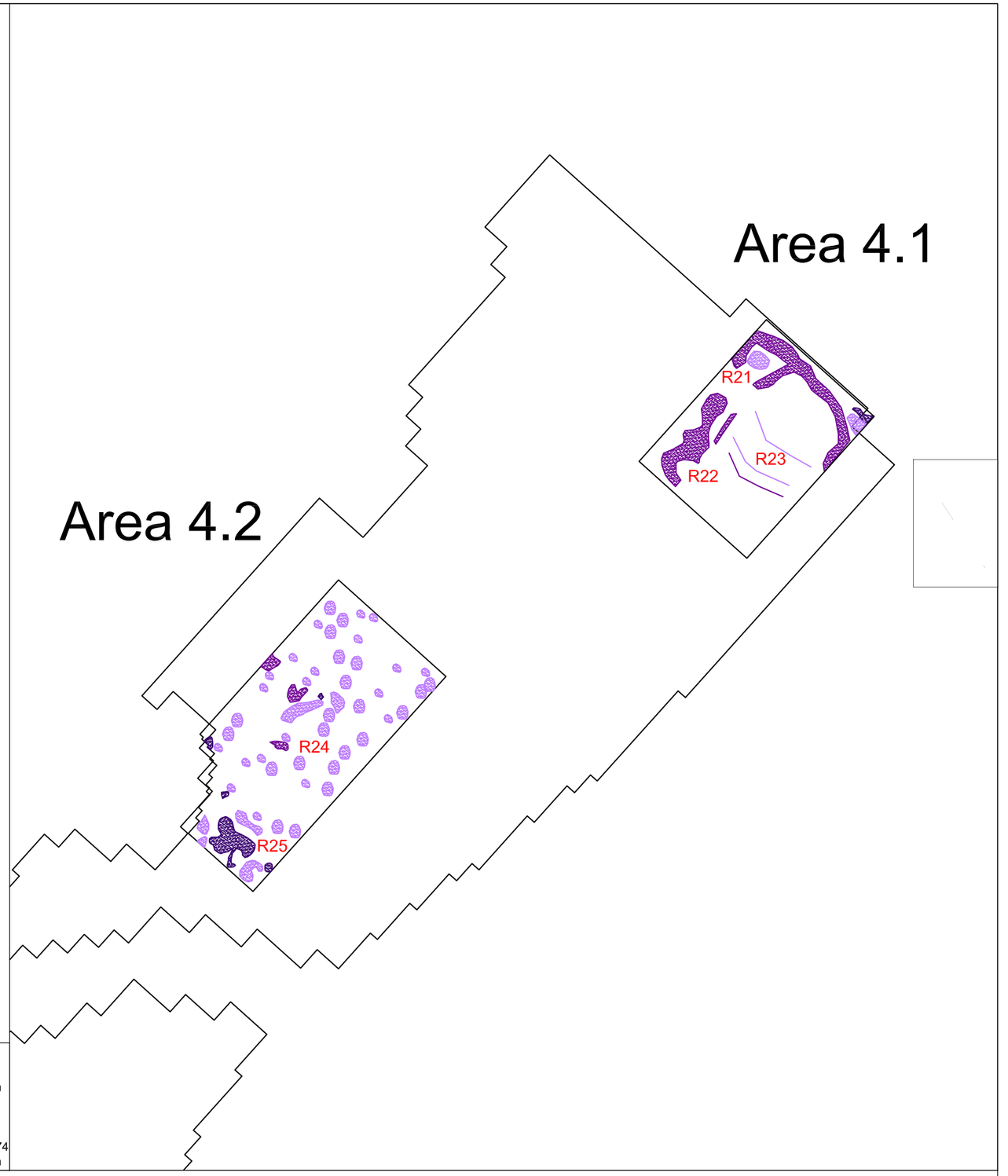
1:1000 at A3

Project Title: A9 Dualling - Dalraddy to Slochd Project No: 51846		
Drawing Title: Figure 19 - Processed Gradiometer survey results & Minimally processed Earth Resistance survey results - Area 4		
V1/51846/GEO/F19/03.01.18		
Drawn by: KT	Checked by: JL	Approved by: JL
03/01/2018	03/01/2018	03/01/2018

AOC Archaeology Group



Processed Earth Resistance survey results - Area 4



Interpretation of Earth Resistance survey results - Area 4

Figure
20

Red Line Boundary

Low Resistance

High Resistance

Very High Resistance

N

0 40m

1:1000 at A3

Project Title: A9 Dualling - Dalraddy to Slochd		
Project No: 51846		
Drawing Title: Figure 20 - Processed Earth Resistance survey results & Interpretation of Earth Resistance survey results - Area 4		
V1/51846/GEO/F20/05.01.18		
Drawn by: KT	Checked by: JL	Approved by: JL
05/01/2018	05/01/2018	05/01/2018

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Appendix 1: Characterisation of Identified Anomalies

Gradiometer survey

Area 1 - Specific Anomaly Code: **A**

Anomaly	Type of Archaeology
A1	Negative Linear / Curvilinear trends – Unclear origins
A2	Negative Linear / Curvilinear trends – Unclear origins
A3	Linear trend – Unclear origins
A4	Discrete Pits
A5	Linear trend – Possible service

Area 2 - Specific Anomaly Code: **B**

Anomaly	Type of Archaeology
B1	Negative trend – Unclear origin
B2	Linear and Rectilinear trends – Unclear origins
B3	Curvilinear trend – Unclear origins
B4	Linear trend – Unclear origin
B5	Rectilinear trends – Unclear origins
B6	Trends – Unclear origins
B7	Trends – Unclear origins
B8	Rectilinear trend – Unclear origin
B9	Magnetic disturbance – Unclear origin
B10	Magnetic disturbance – Unclear origin
B11	Discrete Pit
B12	Geology
B13	Geology
B14	Geology
B15	Geology
B16	Geology
B17	Geology
B18	Magnetic Disturbance - Modern
B19	Magnetic Disturbance - Modern
B20	Magnetic Disturbance - Modern

Area 3 - Specific Anomaly Code: **C**

Anomaly	Type of Archaeology
C1	Rectilinear trend – Unclear origins
C2	Linear trends – Unclear origins
C3	Linear trends – Unclear origins
C4	Linear trends – Unclear origins
C5	Geology
C6	Geology
C7	Magnetic disturbance - Modern
C8	Magnetic disturbance - Modern

Area 4 - Specific Anomaly Code: **D**

Anomaly	Type of Archaeology
D1	Anomaly – Unclear origins
D2	Magnetic disturbance – Unclear origins
D3	Linear trend – Unclear origins
D4	Curvilinear trend – Unclear origins
D5	Curvilinear trend – Unclear origins
D6	Curvilinear trend – Unclear origins
D7	Curvilinear trend – Unclear origins
D8	Magnetic disturbance – Unclear origins
D9	Magnetic disturbance – Unclear origins
D10	Geology
D11	Possible Modern Service

Earth Resistance survey

Site Specific Anomaly Code: **R**

Anomaly	Type of Archaeology
R1	Possible enclosure – High resistance
R2	Possible enclosure – Low resistance
R3	Low resistance
R4	High resistance – agricultural
R5	Low resistance
R6	High & low resistance - trackway
R7	High resistance
R8	High & low resistance
R9	High & low resistance
R10	Low resistance - vegetation
R11	High resistance
R12	High resistance
R13	High & low resistance trends
R14	High resistance

R15	Very high resistance
R16	High & low resistance trends - geological
R17	High & low resistance trends - geological
R18	High & low resistance – agricultural
R19	Very high resistance
R20	Very high resistance
R21	High & low resistance – possible archaeology
R22	High resistance
R23	High resistance
R24	Mottled high & low resistance - vegetation
R5	Very high & low resistance

Appendix 2: Survey Metadata

Field	Description
Surveying Company	AOC Archaeology
Data collection staff	Alistair Galt, Dan Shiel, Leoni Teufel
Client	AMJV
Site name	A9 Dualling - Dalraddy to Slochd
County	
NGR	NH 86815 10080 – NH 90963 17773
Land use/ field condition	Pasture
Duration	21/11/17 – 30/11/17
Weather	Overcast / Snow
Survey type	Gradiometer & Earth Resistance Survey
Instrumentation	Trimble GXOR system Bartington Grad 601-2 Earth Resistance – RM15 and MPX15
Area covered	Approx 8 ha (Grad - 163 full and partial. Res – 31 grids)
Download software	Grad601 PC Software v313
Processing software	Geoplot v3.0 / v4.0
Visualisation software	AutoCAD LT 2009
Geology	In Area 1 the bedrock recorded geology is the Monadhliath Pluton, consisting of porphyritic Silurian granites. These are overlain by Quaternary fluvial alluvial fan deposits of gravel, sand, silt and clay. In Area 2 the bedrock recorded geology is the Loch Laggan psammite formation, consisting of a metamorphic bedrock. These are overlain by Devensian glaciofluvial sheet deposits of sand, gravels and boulders. In Areas 3 and 4 the bedrock recorded geology is the Boat of Garten pluton, porphyritic tonalite and porphyritic igneous Silurian bedrocks. These are overlain by Devensian glaciofluvial gravels, sands and silts.
Soils	Humus-iron podzols (Scotland's Soils, 2017).
Scheduled Ancient Monument	No
Known archaeology on site	None
Historical documentation/ mapping on site	None
Report title	A9 Dualling – Northern Section: Dalraddy to Sloch, Scotland: Archaeological Geophysical Survey
Project number	51846
Report Author	Kimberley Teale
Report approved by	James Lawton

Appendix 3: Archaeological Prospection Techniques, Instrumentation and Software Utilised

Gradiometer survey

Gradiometer surveys measure small changes in the earth's magnetic field. Archaeological materials and activity can be detected by identifying changes to the magnetic values caused by the presence of weakly magnetised iron oxides in the soil (Aspinall *et al.*, 2008, 23; Sharma, 1997, 105). Human inhabitation often causes alterations to the magnetic properties of the ground (Aspinall et al, 2008, 21). There are two physical transformations that produce a significant contrast between the magnetic properties of archaeological features and the surrounding soil: the enhancement of magnetic susceptibility and thermoremnant magnetization (Aspinall *et al.*, 2008, 21; Heron and Gaffney 1987, 72).

Ditches and pits can be easily detected through gradiometer survey as the top soil is generally suggested to have a greater magnetisation than the subsoil caused by human habitation. Also areas of burning or materials which have been subjected to heat commonly have high magnetic signatures, examples include: hearths, kilns, fired clay and mudbricks (Clark 1996, 65; Lowe and Fogel 2010, 24). It should be noted that negative anomalies can also be useful for characterising archaeological features. If the buried remains are composed of a material with a lower magnetisation compared with the surrounding soil, the surrounding soil will consequently have a greater magnetisation resulting in the feature displaying a negative signature. For example stone materials of a structural nature that are composed of sedimentary rocks are considered non-magnetic and so will appear a negative features within the data set.

Ferrous objects- i.e. iron and its alloys- are strongly magnetic and are typically detected as high-value peaks in gradiometer survey data, though it is not usually possible to determine whether these relate to archaeological or modern objects.

Although gradiometer surveys have been successfully carried out in all areas of the United Kingdom, the effectiveness of the technique is lessened in areas with complex geology, particularly where igneous and metamorphic bedrock is present. All magnetic geophysical surveys must therefore take the effects of background geological and geomorphological conditions into account.

Gradiometer survey instrumentation

AOC Archaeology's gradiometer surveys are carried out using Bartington Grad601-2 magnetic gradiometers. The Grad601-2 is a high-stability fluxgate magnetic gradient sensor, which uses a 1m sensor separation. The detection resolution is from 0.03 nT/m to 0.1nT/m, depending on the sensor parameters selected, making the Grad601-2 an ideal instrument for prospective survey of large areas as well as detailed surveys of known archaeology. The instrument stores the data collected on an on-board data-logger, which is then downloaded as a series of survey grids for processing.

Gradiometer survey software

Following the survey, gradiometer data is downloaded from the instrument using Grad601 PC Software v313. Survey grids are then assembled into composites and enhanced using a range of processing techniques using Geoscan Geoplot v3.0 / v4.0 (see Appendix 4 for a summary of the processes used in Geoplot and Appendix 5 for a list of processes used to create final data plots).

Earth Resistance survey instrumentation

AOC Archaeology's Earth Resistance Surveys are conducted using a Geoscan Research RM15 resistance meter, with a set number of probes and remote probes depending on the chosen survey methodology, utilising a MPX15 multiplexor attachment if required (see Appendices 2 and 3).

Data was collected on an east-west alignment using zig-zag traverses, with a sample interval of 0.5m and a traverse interval of 2m. The gain was set appropriate to ground conditions and the local geology.

Earth Resistance survey software

Following completion of the survey, the earth resistance data is downloaded from the instrument using Geoplot v3.0 / v4.0. The survey grids are then assembled into composites and enhanced using a range of processing techniques using Geoscan Geoplot v3.0 / v4.0 (see Appendix 4 for a summary of the processes used in Geoplot and Appendix 5 for a list of processes used to create final data plots).

Appendix 4: Summary of Processes used in Geoplot

Process	Effect
Clip	Limits data values to within a specified range
De-spike	Removes exceptionally high readings in the data that can obscure the visibility of archaeological features. In resistivity survey, these can be caused by poor contact of the mobile probes with the ground. In gradiometer survey, these can be caused by highly magnetic items such as buried ferrous objects.
De-stagger	Corrects a misalignment of data when the survey is conducted in a zig-zag traverse pattern.
Edge Match	Counteracts edge effects in grid composites by subtracting the difference between mean values in the two lines either side of the grid edge.
High pass filter	Removes low-frequency, large scale detail in order to remove background trends in the data, such as variations in geology.
Interpolate	Increases the resolution of a survey by interpolating new values between surveyed data points, creating a smoother overall effect.
Low Pass filter	Uses a Gaussian filter to remove high-frequency, small scale detail, typically for smoothing the data.
Periodic Filter	Used to either remove or reduce the appearance of constant and reoccurring features that distort other anomalies, such as plough lines.
Wallis filter	Applies a locally adaptive contrast enhancement filter.
Zero Mean Grid	Resets the mean value of each grid to zero, in order to counteract grid edge discontinuities in composite assemblies.
Zero Mean Traverse	Resets the mean value of each traverse to zero, in order to address the effect of striping in the data and counteract edge effects.

Appendix 5: Survey Processing Steps

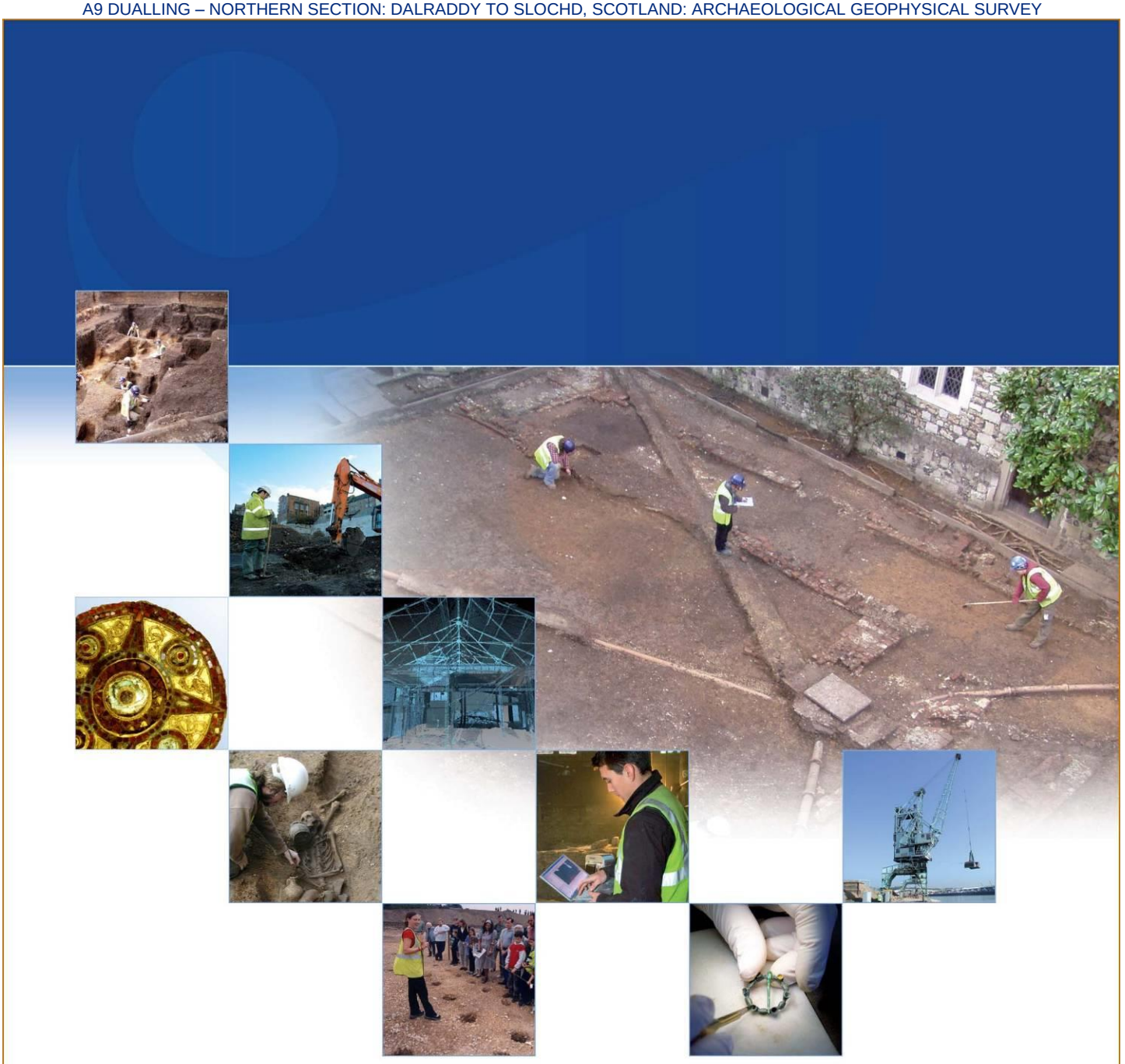
Gradiometer survey	
Process	**Extent**
Zero Mean Traverse	All LMS =on, threshold -5 to 5
Despike	X=1 Y=1 Thr = 3 Repl = Mean
Clip	Min =-5 Max = 5
Destagger	All grids dir Shift = 2 Line Pattern 34-78 Dual-DS
Low Pass filter	X=1 Y=1 Wt=G
Interpolate	Y, Expand – Expand –SinX/X x2
Raw Palette Scale	Grey08 Min= -1nT Max= 2nT
Palette Scale	Grey08 Min= -1nT Max= 2nT

Resistance survey	
Process	**Extent**
Despike	X=1 Y=1 Thr = 3 Repl = Mean
Clip	Min = -5 Max = 5
High Pass filter	HPF x=10 y=10 wt =u
Interpolate	X, Expand – sin x/x Y, Expand – sin x/x
Palette Scale	Grey55

Appendix 6: Technical Terminology

Type of Anomaly	Description
Archaeology	
Archaeology - Trend	These are made up of linear / curvilinear / rectilinear anomalies and are either characterised by an increase or decrease in values compared to the magnetic background. This evidence is normally supported by the presence of archaeological remains and is confirmed by other forms of evidence such as HER records and aerial photography.
Archaeology - Area of Disturbance	This is characterised by a general increase and decrease of magnetic responses over a localised area and does not appear as having a linear form. These anomalies do not have the high dipolar response which are manifested in an 'iron spike' anomaly. This anomaly may be supported by the known location of a former building, or other forms of evidence such as HER records and aerial photography.
Archaeology - Pit	An anomaly composed of an increase in magnetic values with a patterning on the XY trace plot that is suggestive of buried remains, such as the infill of a pit. This evidence is normally supported by the presence of archaeological remains and is confirmed by other forms of evidence such as HER records and aerial photography.
Discrete Archaeology	
Archaeology? – Trend	Anomalies of a linear / curvilinear / rectilinear form either composed of an increased or decreased signal compared to magnetic background values. It is possible these anomalies belong to archaeological remains, but poor patterning or weaker response values makes interpretation difficult. Where historical records are present, the anomalies would appear to be weak or inconclusive.
Archaeology? - Area of Disturbance	Anomalies with an increase or decrease in magnetic values compared with the magnetic background over a localised area. Poor patterning or weak signal changes creates difficulty in defining the origin of the anomaly and so interpretation is only tentative. The anomaly lacks definitive records to confirm its origin as being archaeological. Disturbed areas could indicate the presence of buried rubble relating to fallen structures, or instead denote modern material from either quarrying or agricultural activity. On certain geologies these anomalies could be caused by in-filled natural features.
Archaeology? – Pit	An anomaly composed of an increase in magnetic values with a patterning on the XY trace plot that is suggestive of buried remains, such as the infill of a pit, but is isolated in its location and association with other features.
Unclear Origin	
Linear Trend	Anomalies of a linear / curvilinear form which are composed of a weak or different change in magnetic values. Coupled with poor patterning, the anomaly is difficult to interpret and it is unclear whether it has an archaeological origin.
Area of Disturbance	An area of magnetic disturbance which consists of a variety of increased and decreased magnetic values compared with background readings, but lacks sufficient patterning or context for a conclusive interpretation. It is likely that these readings are caused by modern disturbances, but interpretation is tentative.

Agricultural	
Linear Trend (Old Field Boundary)	These isolated long linear anomalies, most often represented as a negative magnetic trend, are likely to relate to former field boundaries. The magnetic signal may appear inconsistent but when the positioning is cross referenced with historic mapping, it is confirmed as a former field boundary.
Linear Trend (Old Field Boundary?)	These isolated long linear anomalies, most often represented as a negative magnetic trend, are likely to relate to former field boundaries. The positioning is not supported by historic mapping, but is often confirmed with adjacent ploughing patterns.
Linear Trend (Ridge and Furrow / Rig and Furrow)	A series of regular linear anomalies either composed of an increased or decreased magnetic response compared to background values. The width between the anomalies is consistent with that of a Ridge and Furrow ploughing regime, which is normally wider than conventional ploughing methods.
Linear Trend (Conventional ploughing)	A series of regular linear anomalies either composed of an increased or decreased magnetic response compared to background values. The regular patterning is likely to denote the presence of ploughing, however isolated trends can occasionally be observed that follow the orientation of ploughing trends seen elsewhere in the area. Anomalies seen adjacent to field edges are representative of headlands caused by ploughing.
Linear Trend (field drainage)	A series of linear anomalies of an indeterminate date, usually with a regular or herringbone patterning and regular spacing. These are likely to represent agricultural activity such as land drainage.
Non- Archaeology	
Geology / Natural	An area of disturbance that is composed of irregular significant increases or decreases in magnetic values compared with background readings and is likely to indicate natural variations in soil composition or geology.
Linear Trend (possible modern service)	Anomalies of a linear form often composed of contrasting high positive and negative values. Such anomalies usually signify a feature with a high level of magnetisation and are likely to belong to modern activity such as pipe lines or modern services.
Disturbed Area (modern disturbance?)	An area of disturbance that is likely to be caused by modern activity and is characterised by significant increases or decreases in magnetic values compared with background readings.
Isolated Dipolar Anomalies / Ferrous (iron spikes)	A response normally caused by ferrous materials on the ground surface or within the top soil, which causes a ‘spike’ representing a rapid variation in the magnetic response. These are generally not assessed to be archaeological when surveying on rural sites, and generally represent modern material often re-deposited during manuring.



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