



Geophysical Survey Report No. 38

NIEA License Number AE/16/201

**Aghagallon Enclosure Interior,
Co. Antrim**

Dr Siobhán McDermott

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Summary of results

An evaluation resolution electrical resistance survey was carried out over a total area of c. 1 hectare within the interior of a large, single banked enclosure (ANT 066:001) in the hamlet of Aghgallon. Magnetic gradiometry had been trailed at the site during a previous programme of geophysical survey¹ but the underlying basalt geology and surrounding electromagnetic interference prevented its successful application. Indeed the level of electrical interference was so high within the interior of the monument that the operating frequency of the RM85 electrical resistance meter had to be increased during the most recent survey.

The electrical resistance or earth resistivity data was collected using three probe spacings: 0.5m, 1m and 2m. The widest probe spacing (2m) allows the deepest penetration ($\approx 0.7\text{m}/\approx 1.3\text{m}$) and is not commonly used in archaeological geophysical survey. The decision to collect data at this depth and resolution at Aghagallon was taken as the site has been landscape to create a modern playing field and there was the likelihood of a deep layer of overburden. This approach was deemed to be successful as it identified the deeply buried feature r_1b.

The 2016 electrical resistance survey has identified a number of anomalies with a high level of archaeological potential which could radically change our understanding of the site. Primarily it identified two possible enclosures (B & C) set within the single banked monument (see Figure 4 and discussion below). The data suggests that the outer bank was re-aligned at some period in the past when it may have been expanded to form Enclosure A, the single extant bank. The other two enclosures area associated with a series of high resistance readings and are set concentrically within the outer bank. The geophysical returns would appear to undermine the interpretation of the single bank as a henge-form monument instead in form it appears to be more akin to an early monastic settlement. Research-led, targeted excavation should be able to further our understanding of the site.

¹ McDermott, S., [2015] *Geophysical Survey Report No. 34: Aghagallon Enclosure, Co. Antrim*. Unpublished report lodged with the Historic Environment Division, license number AE/15/38.

Site Specific Information

Site Name: Aghgallon Enclosure, Co. Antrim

Townland: Derrynaseer

SMR No: ANT 066:001

Grid Ref: J 10530 63552

County: Antrim

Date of Survey: 12th – 16th December 2016

Surveyors Present: Siobhán McDermott, Grace Macalister & Ruth Logue Centre for Archaeological Fieldwork, School of Geography, Archaeology and Paleoecology, Queens University, Belfast.

Size of area surveyed: 1 hectare

Weather conditions: Mild.

Solid Geology: Lower Basalt Formation: Antrim Lava Group

Drift Geology: Diamicton till

Current Land Use: Playing fields

Intended Land Use: N/a

Survey methodology overview

Survey type:

Electrical resistance

Instrumentation:

Geoscan RM85

Probe spacing:

Multiple five probe array (2m + 1m x 2, + 0.5m x 4)

Grid size:

20m x 20m

Traverse interval:

2m/1m/0.5m

Sample Interval:

1m

Traverse Pattern:

Parallel

Lecia TS06-plus total station

Survey grid setup:

Established with differential GNSS

Survey Internal Accuracy:

Survey grade accuracy (<3cm)

Georeferencing:

The EDM data will be used to georeference the geophysical survey datasets exported from Geoplot v.3 in ArcMap 10.3.

Data processing:

The geophysical data was processed in Geoplot v. 4 software. The primary processes applied were high pass filtering (HPF) to remove geological 'background' noise and low pass filtering (LPF) which helps to eradicate minor spikes in the data. The datasets were also interpolated which creates a smoothing effect.

Visualisations:

The datasets were visualised within Geoplot v.4 using shade, trace, compression and relief plots. Processed datasets and bitmap graph plots were exported from Geoplot v.4 and imported into ArcGIS 10.3. Once georeferenced statistical analysis were carried out on the rasters within ArcGIS 10.3 and they were interpreted in relation to the available historical Ordnance Survey maps of the area and orthorectified aerial imagery.

Digital archive:

The geophysical datasets were collected, processed and archived in accordance with Archaeological Data Services best practice.²

² Schmidt, A. & E. Ernenwein, 2011, Guide to good practice: Geophysical data in Archaeology [Online]
http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics_Toc

Introduction

A characterisation resolution earth resistivity survey was carried out over a total area c. 1 hectare within the interior of a large, single banked enclosure (ANT 066:001). The enclosure has an overall diameter of c. 160m east to west. The electrical resistivity data was surveyed at Aghgallon using a 2m beam collecting seven readings at each sample position that were then correlated into three separate sets of data at three probe spacings: 0.5m, 1m and 2m. Resistivity is measured in ohm-meter (Ω -m) or the resistance of one meter cube of the material when a potential difference of one volt is applied.³ So conductors such as copper have low resistivity whereas insulators, such as clay and stone, have high resistivity. The survey method is highly dependent on soil moisture levels which effects how resistance material is to an electrical current being passed through it. It is also effected by the probe spacing, where increasing the distance of the probe spacing on the beam will increase the depth to which the signal penetrates. However subtle features may be lost on wider probe spacing datasets as they become a smaller proportion of the wider surveyed area. This means the 2m probe spacing should be understood as lacking resolution with a reduced signal strength but it does supply useful information about the depth distribution of changing soil resistance. This approach was employed at Aghgallon because of the likelihood of overburden as a result of modern landscaping on the site.

The hamlet of Aghgallon is situated just under 3km east of the south-eastern shores of Lough Neagh. The surrounding landscape is characterised by low-lying, marshy former wetlands with small protruding drumlins. Numerous drainage channels and the Lagan Canal are indicative of the sustained improvement of these former wetlands which included peat extraction. The extensive nature of this peat extraction has shaped the topography of the landscape with notable changes in surface levels passing from one peat bank to another.

The enclosure is located to the south of Aghgallon Roman Catholic Church. A graveyard and parking lot occupies the north-eastern half of the interior of the enclosure. This appears to have occurred at some stage between the 3rd and 5th (1900 – 37) edition Ordnance Survey mapping of the area. The remaining undeveloped portion of the interior of the enclosure is currently used as a playing field. Modern housing has heavily encroached along the western exterior during the latter half of the 20th century.

³ Clark, O. A. 1997, *Seeing beneath the soil* (New York), p 27.



Figure 1 Location and landscape setting of the geophysical survey marked in red (OSNI 10km vector data layered over 5km DEM Hillshade).*

Historical & archaeological background

Little is known about the site itself beyond it is a large enclosure (c. 160m diameter). The scale of the structure has drawn comparisons with the Giant's Ring (DOW 009:036), Co. Down, which is a large embanked prehistoric ritual enclosure. With a diameter of 225m and a single earthen bank, 4m high and 19m wide, the Giant's Ring dwarfs the Aghagallon enclosure (the partially surviving bank at Aghagallon measures 1.2m high, 2.8m wide). Limited geophysical survey at two similar large embanked enclosures, Micknastown & Balrath, both Co. Meath, have revealed the arc of a possible trench or ditch 3–4m wide within the interior of the monuments⁴ This is typical of henge-like monuments where the enclosing bank is the outermost element. Geophysical survey carried out over a small section of the eastern portion of the enclosing bank did identify a high resistance linear feature (r_1) which cast doubts on this being a typical henge-form monument.⁵ As with other examples of Irish henge monuments the Giant's Ring is just one of a

⁴ Waddell, J., 2010 *The prehistoric archaeology of Ireland*. (Dublin), 110.

⁵ McDermott 'Aghagallon enclosure: CAF GSR 034', p 9.

Description and interpretation of anomalies (Figure 3)

As stated above it must be remembered that although data was collected using three probe spacings; 0.5m, 1m and 2m. The wider the probe spacing the deeper the signal will penetrate. However this does not necessarily increase the likelihood of identifying deeply buried discrete features as the wider spacings lose resolution. Partly because data was collected at a 1m by 2m sampling density as opposed to the 1m by 0.5m of the narrower probe spacing but also because those features with smaller dimensions now make up a lower ratio of the sampled volume. The loss of resolution must be remembered when comparing data from the three different probe spacings as an aid to interpretation.

Table 1 Description and interpretation of archaeological anomalies.

Code	Description	Interpretation
r_1a & r_1b	Higher resistance curvilinear anomaly along the northern edge of the survey area. Located to the west and off-centre within the enclosing bank. The feature is traceable for a distance of c. 40m forming a semi-circle with a diameter of c. 34m. It is captured at all three depths datasets (0.5m, 1m & 2m probe spacing) although its westernmost arm (r_1b) is most evident at the deeper depth (2m probe spacing). The band has a maximum width of c. 2.5m.	<p>The anomaly is best defined in its eastern extent it loses definition at its westernmost limits. With the latter most clearly traceable in the 2m probe spacing dataset. The wider probe spacing penetrates deeper, but loses resolution, suggesting that modern landscaping to level the playing fields may have buried the western section of the feature.</p> <p>It is possible that r_1a & r_1b represent human activity. Given the form and position of the feature, off-centre within the wider enclosure, this may be a separate phase of activity to that which created the enclosing bank. The higher resistance nature of the returns suggest the remnants of a levelled bank or a ditch infilled with a higher resistance fill.</p>
r_2	<p>Subtle, higher resistance circular anomaly which can be partially traced on 0.5m probe spacing dataset. Not clearly identifiable on the wider (deeper) probe spacing. Appears to be enclosed by r_1.</p> <p>The feature encloses an area with a diameter of c. 5.5m. The band of readings has a width of just over 1m. It is situated about 2m inside the southern section of r_1a.</p>	<p>The anomaly is most clearly identified on the 0.5m probe spacing dataset. However its apparent absence from the wider, and therefore deeper, datasets may reflect loss of resolution rather than absence of evidence. The width of the feature is quite narrow with the returns subtle, most easily traced using a targeted colour ramp on the processed dataset, but evident in the raw data also.</p> <p>Its form, circular bands, and position, enclosed by r_1 suggest it may be the result of human activity perhaps associated with the same phase as r_1.</p>

r_3a & r_3b	<p>Two straight, parallel, higher resistance linear features running southwest to northeast from the southern edge of the outer enclosing bank through the middle of the survey area.</p> <p>The first r_3a can be traced for a distance of c. 54m, the second r_3b can be traced for a distance of c. 42m.</p>	<p>The anomalies appear to respect and align with a series of pitch markings associated with the modern playing fields. Not of archaeological significance.</p>
r_4a & r_4b	<p>Two irregular area of high resistance. The eastern anomaly (r_4a), c. 8m N-S, 3m E-W, is located to the middle of the easternmost quarter of the survey area. The second feature (r_4b), c. 4m N-S, 4.5m E-W, is located to the middle of the westernmost quarter of the survey area.</p>	<p>The western anomaly is located over a set of goal posts while the eastern is positioned c. 4m back from the second set of goals. These are probably the result of ground being compacted as a consequence of the area being used for sporting activities.</p>
r_5	<p>Subtle higher resistance curvilinear band. Can be traced for a distance of c.27m. The feature has a maximum width of c. 3m. The band has a mean average return of 22 Ω-m, as measured from the 1m probe spacing dataset.</p> <p>Appears to be situated c. 34m within the interior of the enclosing bank running parallel to its southeast portion. May align with r_10 (23 Ω-m) and may respect r_1 (23 Ω-m). Not evident on the 2m probe data and best displayed at 1m resolution.</p>	<p>Appears to align with r_10 and respects the path of the eastern portion of the external bank. Encloses an area of c. 110m in diameter between it and the north-western portion of the enclosing bank.</p>
r_6	<p>Sub-circular area of high resistance (4.5m N-S & E-W) evident on all three data depths. Aligns with a series of similar returns identified as r_7a, r_7b & r_7c which run parallel with R_10.</p>	<p>The location of r_6, apparently associated with r_7 and r_10, suggest it could be the result of human activity. That it can be identified on the wider (deeper) probe data suggests it is a pit, at least 1m deep, filled with higher resistance material.</p>

r_7a, r_7b & r_7c	<p>A series of higher resistance sub-circular anomalies identifiable on the 0.5m and 1m probe data. Appear to form an arc of features aligned with r_6 and running parallel to r_10 at distance of c. 2m. Return strength is more subtle than r_6.</p> <p>The westernmost feature r_7a is a subtle sub-circular area of higher resistance (2.5m N-S, 3.5m E-W) situated c. 1m east of r_6 and c. 1.5m south of r_10. Located 2m further east again is r_7b. Another subtle, sub-circular anomaly smaller in scale (2m N-S & E-W). Just over 6m to the north-east, but following the arc established by r_5 and r_10, is r_7c (3m N-S & E-W).</p>	<p>The three anomalies, along with r_6, form an arc running parallel to that created by r_5 and r_10. They are pit like in form and may be related to the same activity that formed r_5 and r_10, as such they have significant archaeological potential.</p>
r_8	<p>A sub-circular area (7m N-S, 8m E-W) of high resistance along the southern limits of the survey area. Positioned c. 2.5m immediately northeast of the perimeter fencing of new housing development, which encroaches on the enclosure bank. Situated c. 18m west of a collection of anomalies (r_6, r_7 & r_10) which may have archaeological potential.</p> <p>Evident on all three datasets. Appears to be truncated by r_3a.</p>	<p>Anomaly appears to be deep and pre-dates the landscaping of the modern playing fields. Its general location near to a collection of anomalies which may have archaeological potential is interesting. However it may also be the result of the development of modern housing in the area, specifically fencing erected to the back of the houses which hem the southern limits of the enclosure. Possibly the result of human activity but could be related to the more recent activity.</p>
r_9	<p>Irregular linear band of significantly higher resistance (223 Ω-m) abutting the enclosing bank. Traceable for c. 40m running along the western section of the enclosing bank. Maximum width of c. 5m. Greatest area plotted on the 2m probe depth.</p>	<p>The mean zonal resistivity readings of the r_9 are ten times greater than mean average for the three datasets. Appears to be an area of high resistance associated with the enclosing bank perhaps associated with an episode of realignment of the bank.</p>

r_10	Weak, curvilinear feature traceable for c.25m, in 1m dataset, width c. 2m. Appears to align with r_5 and runs parallel to an arc of anomalies created by r_6 & r_7. Most evident on 1m probe dataset.	Feature is incredibly subtle and only evident in the 1m dataset. It is possible that this is a processing anomaly as the wider 1m probe spacing penetrates deeper but loses resolution and what is being recorded are the returns associated with r_16. It either scenario the position of r_10 (possibly r_16) aligned with r-5, r_6 and r_7 suggest that this could be associated with human activity.
r_11	Irregular, weak, linear feature running southwest to northeast for a distance of c. 18m. Appears to run from the southern limits of r_4 towards r_3b.	The spatial relationship with r_4 and r_3b indicate a possible relationship to the contemporary use of the area as playing fields.
r_12	Weak, curvilinear response towards the eastern limit of the survey area. Enclosing an oval area c. 7.5m E-W, 3.5m N-S. Identifiable in the 2015 data as r_4 'a cluster of higher resistance readings'. ⁶	Difficult to interpret by itself but its form and dimensions suggests it could be some type of hut site. Although noted in 2015 the returns were quite anomalous. The form of the feature is better defined in the 2016 dataset. Variations in earth resistivity due to changes in environmental influences is well documented. ⁷ Factors such as humidity levels can obscure or accentuate buried features. In hindsight, the form of r_12 can be made out in the 2015 dataset but realistically it is better understood when interpreted in a larger dataset with evident of other curvilinear returns.
r_13	Globular collection of high resistance readings situated c.2m west of r_6 running north-northwest to south-southeast. Recorded for a distance of c. 7m NNW-SSE, 2.5m E-W. Evident on the 1m and 0.5m probe spacing raw data.	Possibly associated with r_6 but the anomalous form of the returns makes them difficult to interpret any further.

⁶ McDermott 'Aghagallon enclosure: CAF GSR 034', p 9.

⁷ Schmidt, A., 2013, *Earth resistance for archaeologists*, (Plymouth) pp 123-7.

r_14	<p>Irregular Y-shaped linear extending due south from the southern limit of r_6 towards the enclosing bank, the feature appears to fork two thirds of the way along its length. Traceable for a distance of c. 6m N-S, 5m E-W.</p> <p>Identifiable on the 0.5m & 1m probe spacing data with a fork which appears more angular form in the raw datasets.</p>	<p>Again this anomaly is difficult to interpret. Its form is convoluted, appearing more angular in the raw data with the application of Low Pass filtering and interpolation exaggerating a more sinuous plan. It is likely that the neat circular appearance evident on the processing 0.5m probe data is a false anomaly.</p> <p>It could possibly be archaeological and maybe related to r_6 in some way however little more can be said without excavation.</p>
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Figure 3 (Below) Interpretation diagram with geophysical anomalies identified.



Geophysical anomalies

- | | | | |
|--|---|---------------------------------------|------------------------------------|
| [r_1] Possible internal enclosing feature | [r_7] Smaller pit-like features possible aligned | Semi-circular feature enclosed by r_1 | Associated with modern landscaping |
| [r_5] Possible enclosing feature | [r_14] Irregular linear | Extension of r_1a | Irregular linear, probably modern |
| [r_10] Possible extension of r_5 | [r_13] Series of globular pit-like features | Oval enclosed area | Modern pitch markings |
| [r_9] Probable realignment of enclosing bank | [r_8] Large pit-like feature, possible archaeological | | |
| [r_6] Large pit-like feature, aligned with r_7 | [r_4] Compacted earth near football goals | | |

0 25 50 Meters

Discussion

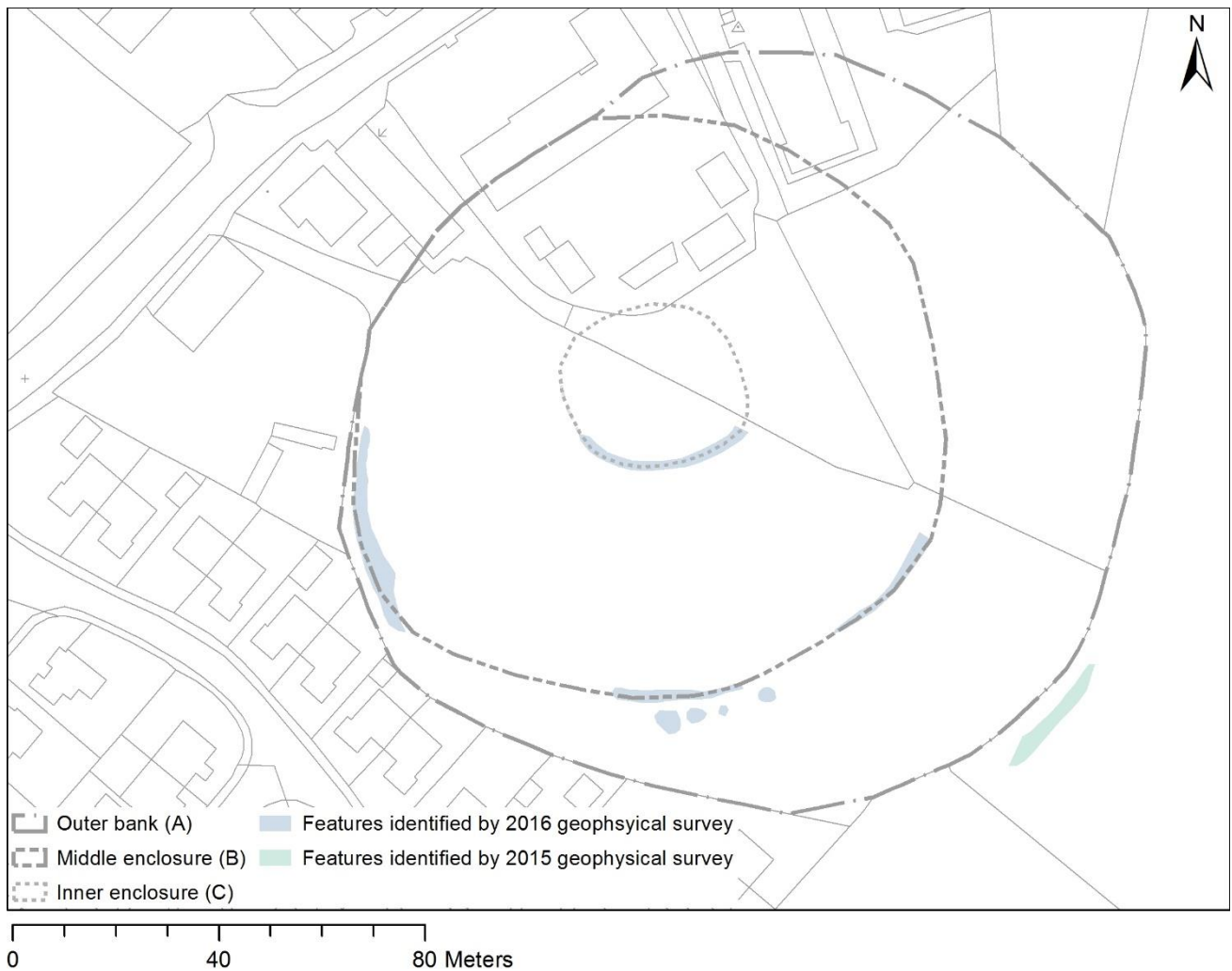


Figure 4 Possible concentric enclosures within the single banked monument as interpolated from the geophysical survey data.

A series of possible enclosures have been identified during the course of this survey and interpolated from the data (Figure 4). The outer enclosure A is the single banked enclosure recorded by the NISMR. It has a diameter of 148m NW – SE. The bank only partially survives, from the east clockwise through to the west, the route of the northern portion has been digitalised for this project from historical maps of the area. The southern portion has been heavily encroached upon by the boundary fencing of modern housing to the south which threatens the integrity of the remaining fabric. Situated within, and off-centre of, the single banked enclosure are a series of high resistance returns which partially trace two concentric enclosures. The path of these have been interpolated from the geophysical plots. Enclosure B would have an overall diameter of c. 114m. It is mapped by the anomalies r_5 and r_10 as well as the feature r_9. The mean average returns for r_9, which are ten times that of the mean of the dataset as a whole, have been interpreted as evidence for a possible episode of realignment of the single enclosing bank. If this is correct then it would appear that the extant monument has seen a number of phases of activity culminating in an episode of expansion. A series of pit-like features, r_6 and r_7, run parallel to the outside section of the southern portion of Enclosure B. Situated at its centre is Enclosure C which is also represented by a series of high resistance returns which are partially mapped and which have been interpolated out. It is situated off-

centre within Enclosure A with a diameter of c. 38m. Located within the inner enclosing element is a semi-circular anomaly r_2 which has a diameter of c. 5.5m.

The returns indicate a strong degree of archaeological potential. A series of high resistance curvilinear returns such as these cannot be easily explained by geological, taphonomic or modern human activity. The concentric nature of the enclosures suggests a forgotten early ecclesiastical site. The discrete anomalies associated with r_2 and r_12 could be contemporary structures, possibly domestic but also maybe workshops.

Recommendations

Research-led excavation should be able to determine the nature of these returns and develop a stronger understanding of the site itself. Confirmation of the nature of the features is paramount as is the retrieval of dating evidence to establish a chronology for the enclosures. Key excavation targets could be:

1. A trench over the inner enclosure targeting r_1a and r_2, a possible structure within Enclosure A.
2. A trench over r_10 which forms part of Enclosure B. It is advisable that this encompass either r_6 or r_7 to establish if these are archaeological in nature and their relationship to Enclosure B.
3. A trench over r_9 to establish if this is a re-aligned enclosing element and determine what material is comprised of.
4. A trench over r_12 to establish if it is a structure of archaeological nature and if it relates to the enclosures themselves.

Acknowledgements

Thank-you to Grace McAlister and Ruth Logue, Centre for Archaeological Fieldwork, Queen's University Belfast, who carried out the fieldwork for this survey.

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Appendix one: Georeferenced geophysical survey grid



Figure 5 Irish National Grid coordinates for geophysical survey grid baseline.*

Appendix two: Raw geophysical survey plots

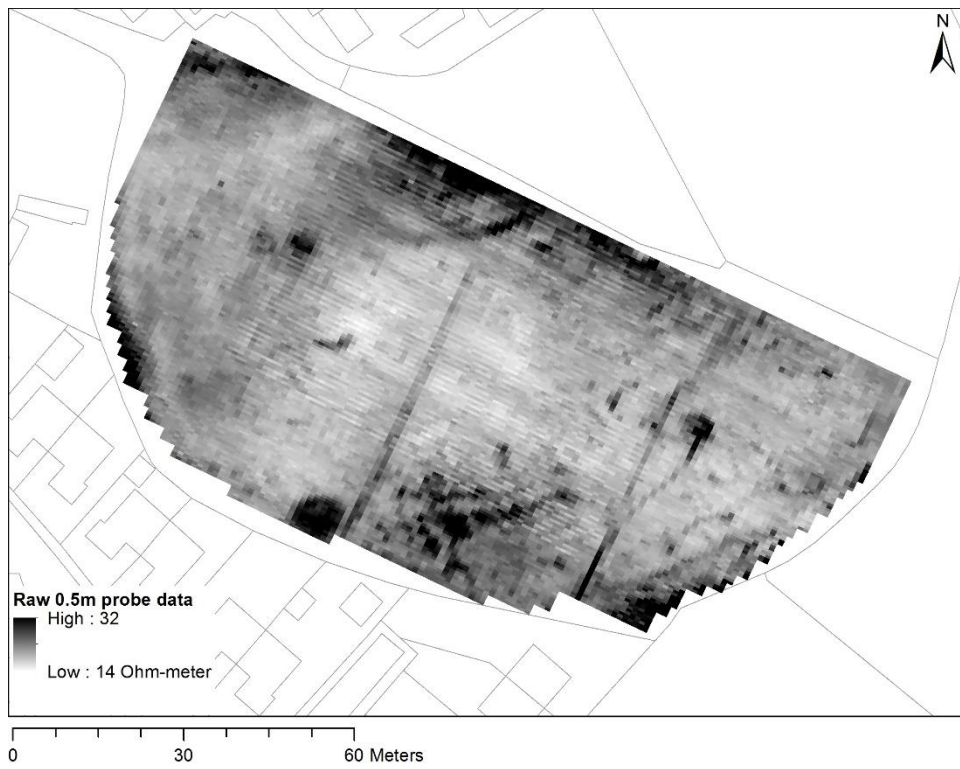


Figure 6 Greyscale plot of raw data gathered with 0.5m probe spacing. Data despiked and converted from resistance readings (Ω) to resistivity (Ω -m). Statistics: Mean: 20.86 Ω -m, Std Dev.: 3.07.*

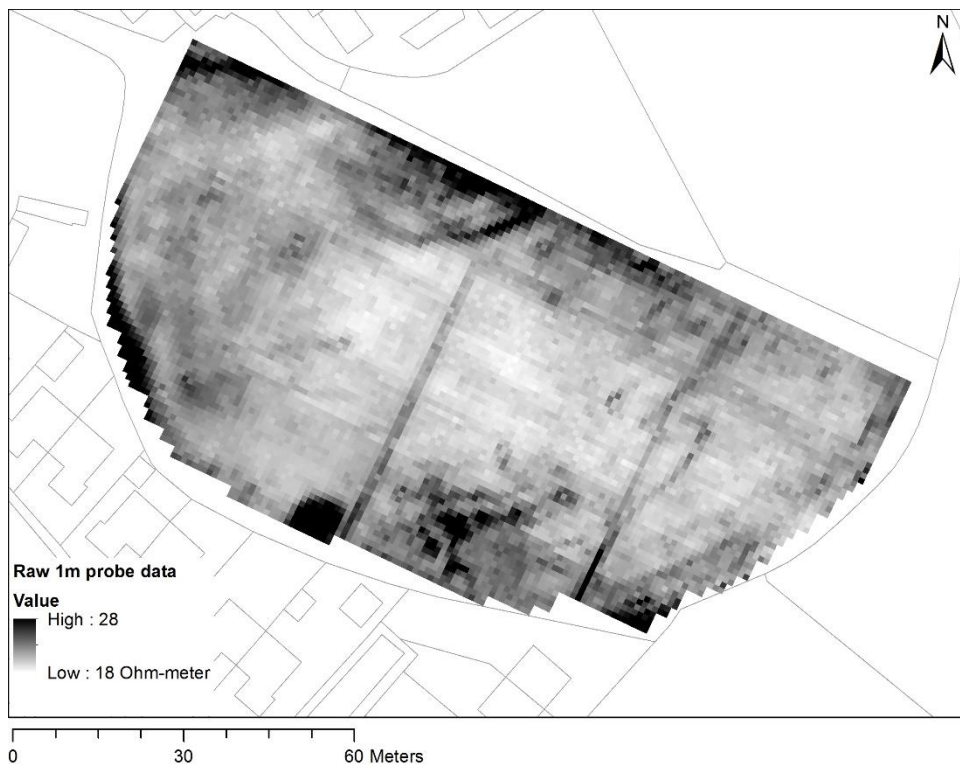


Figure 7 Greyscale plot of raw data gathered with 1m probe spacing.* Data clipped +/- 3 Std Dev. Despiked and converted from resistance readings (Ω) to resistivity (Ω -m). Statistics: Mean: 21 Ω -m, Std Dev.: 1.9.*

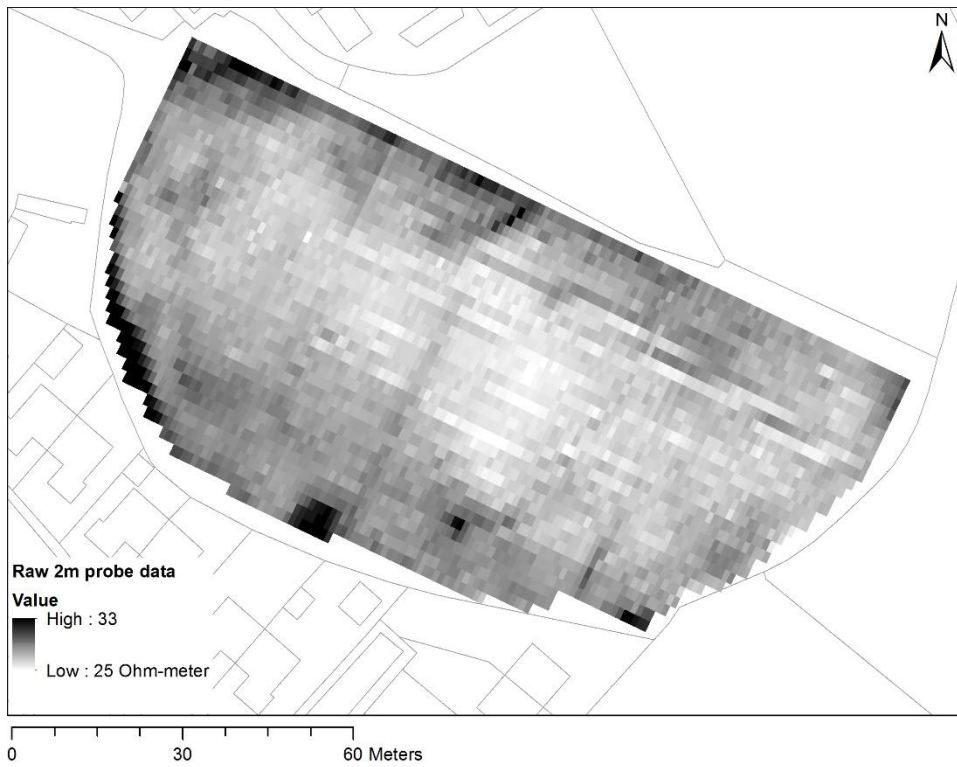


Figure 8 Greyscale plot of raw data gathered with 2m probe spacing.* Data clipped +/- 3 Std Dev. Despiked, edge matched and converted from resistance readings (Ω) to resistivity (Ω -m). Statistics: Mean: 27.69 Ω -m, Std Dev.: 1.*

Appendix three: Processed geophysical survey plots

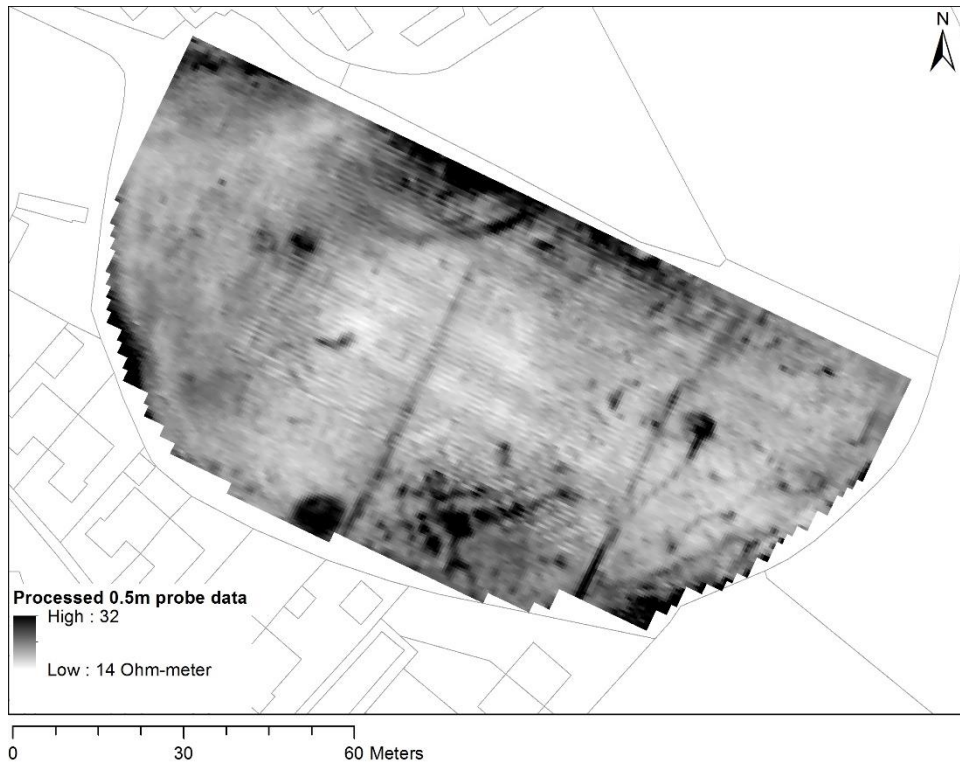


Figure 9 Greyscale plot of processed data gathered with 0.5m probe spacing. LPF (Gaussian weighting applied x1 on x-axis, x1 on y-axis), and $\sin(x)/x$ interpolation on x-axis. Statistics: Mean: 20.86 Ω -m, Std Dev: 2.99.*

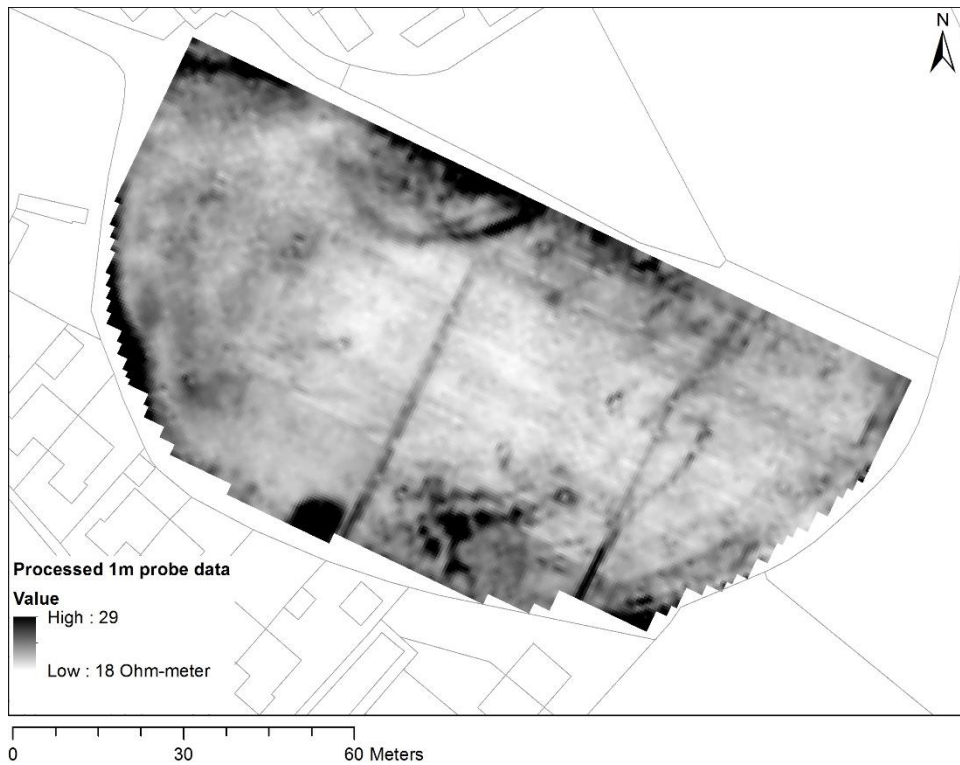


Figure 10 Greyscale plot of processed data gathered with 1m probe spacing. $\sin(x)/x$ interpolation on x- and y-axis. Statistics: Mean: 21.08 Ω -m, Std Dev: 1.89.*

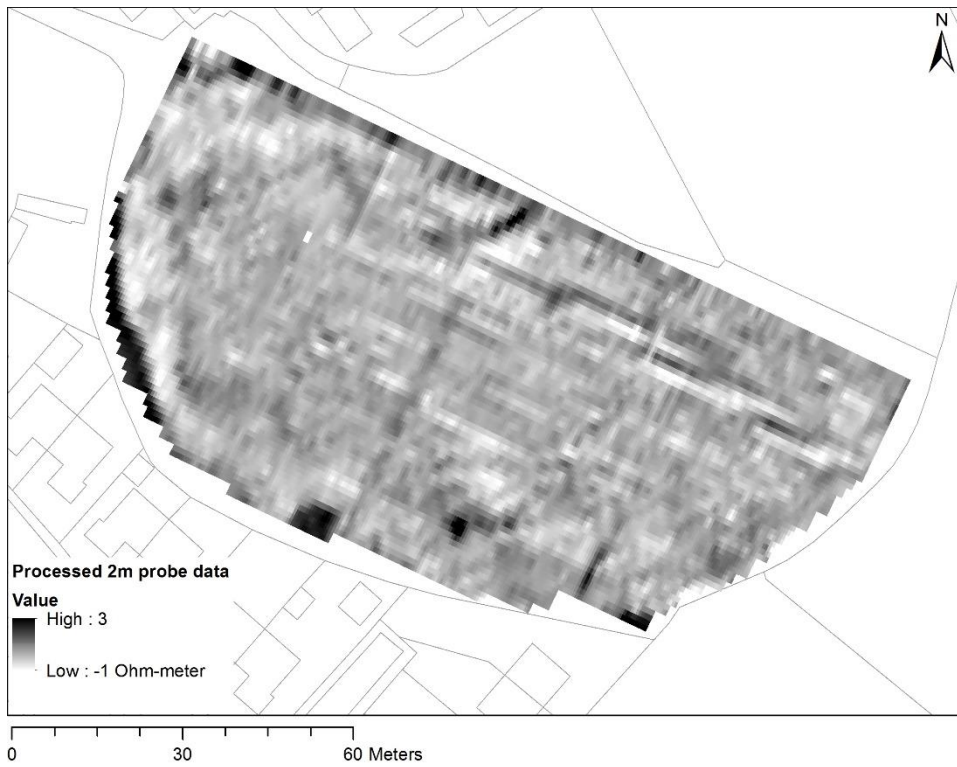


Figure 11 Greyscale plot of processed data gathered with 2m probe spacing. HPF (Gaussian weighting applied $X = 7$, $Y = 7$), LPF (Gaussian weighting applied $x1$ on y -axis), and $\sin(x)/x$ interpolation on x - and y -axis. Statistics: Mean: $-0.01 \Omega\text{-m}$, Std Dev: 0.42 .*

Appendix four: Historical mapping

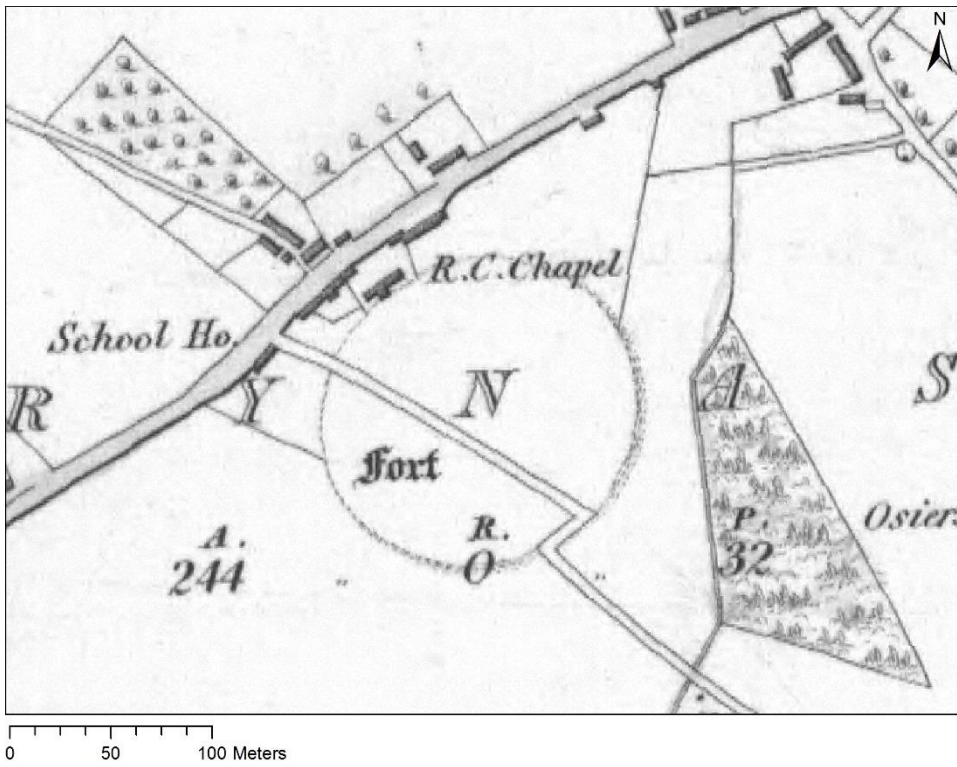


Figure 12 Geophysical survey area in relation to the First Edition Ordnance Survey map series, c. 1831-3.*

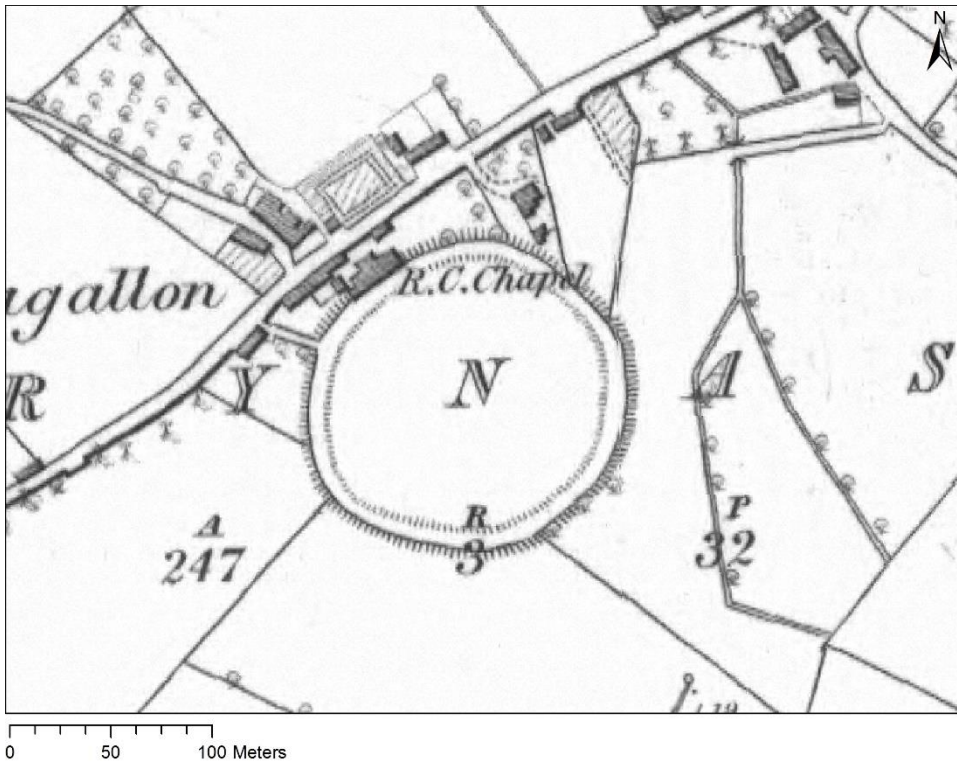


Figure 13 Geophysical survey area in relation to the Second Edition Ordnance Survey map series, c. 1853-58.*



Figure 14 Geophysical survey area in relation to the Third Edition Ordnance Survey map series, c. 1900 – 6.*

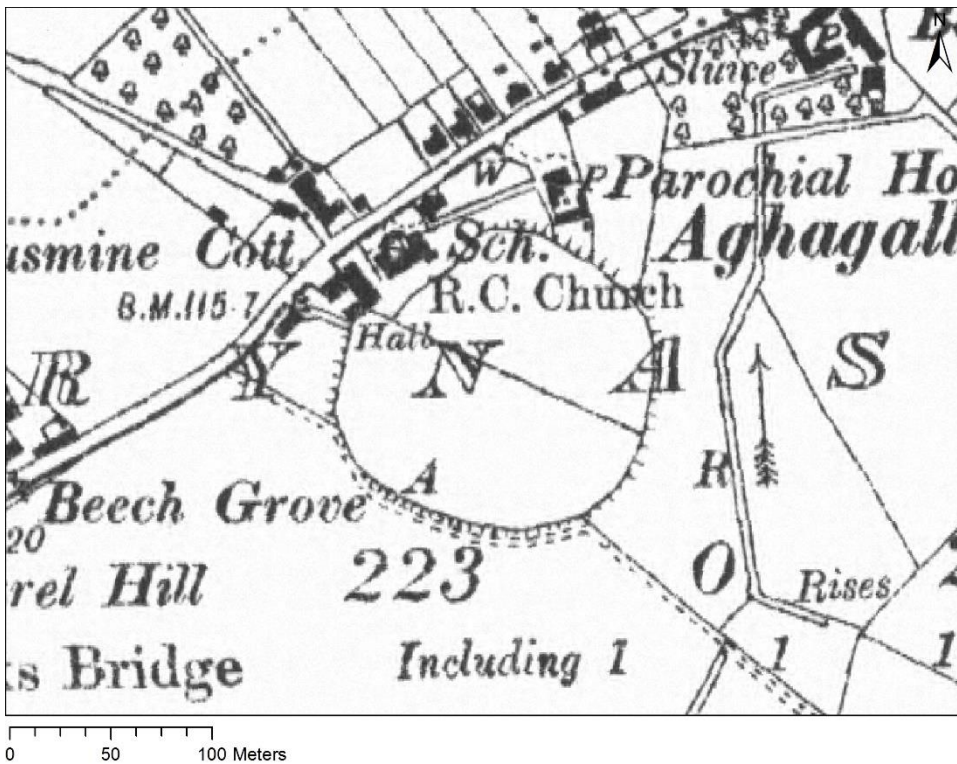


Figure 15 Geophysical survey area in relation to the Fifth Edition Ordnance Survey map series, c. 1931 – 7.*

Appendix five: Aerial imagery



Figure 16 Geophysical survey area in relation to the 2006 ortho-rectified aerial photograph series.*



Figure 17 Geophysical survey area in relation to the 2014 ortho-rectified aerial photograph series.*