

Geophysical Survey Report  
**Lands Adjacent To Granard Motte & Bailey Castle (RMP LF010-080001),  
Granardkill & Moatfield Townlands,  
Granard, County Longford**

Detection License  
**19R0240**

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Client  
**Longford County Council**

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Project  
**TAG1900IE44**



**TARGET**

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An Chomhairle Dídhreactha  
The Heritage Council



## TARGET REPORT 1900IE44

### LANDS ADJACENT TO GRANARD MOTTE & BAILEY CASTLE (RMP LF010-080001), GRANARDKILL & MOATFIELD TOWNLANDS, GRANARD, COUNTY LONGFORD

#### PROJECT BACKGROUND

Geophysical survey was undertaken in the townlands of Granardkill and Moatfield, Co. Longford, on the south-western outskirts of Granard Town, investigating 2 fields situated at the perimeter of Granard motte & bailey castle (LF010-080001), either side of the L5133/Church Street. The L5128, Ardscoil Phádraig Secondary School, and the Moatfield Reservoir lie at the north-eastern perimeter of survey with open pasture land extending to the SW. A total 8.5ha of high resolution magnetic gradiometry was completed in 2 areas (M1-M2) examining all lands suitable to geophysical survey within the study area.

This survey was commissioned by Longford County Council, and forms part of a non-invasive investigation of Granard motte & bailey castle (LF010-080001) and its immediate environs. In addition to the geophysical survey a georeferenced orthomosaic and digital terrain model of the study area were generated from aerial survey completed by Western Aerial Survey. This project is financially supported by the Heritage Council.

This geophysical survey was commissioned with the following aims:

- to identify any geophysical anomalies of possible archaeological origin within the investigation area
- accurately locate these anomalies and present the findings in graphical format
- describe the anomalies and discuss their likely provenance in a written report

**ITM Coordinates** 632650 / 780706 (central coordinate)

**Townlands** Granardkill, Moatfield

**County** Longford

**Landuse** Pasture

**Landscape, soils geology** SW facing pasture land situated 160-170m above sea level occupied by coarse and fine loamy drift of the Knockboy (0960KB) and Crosstown (1030a) Associations (Irish National Soils Map, 1:250,000k, V1b, 2014). Bedrock comprises limestone, calcareous sandstone and shale of the Meath and Moathill Formations (Geological Survey Ireland Spatial Resources, Public Data Viewer Series).

**Archaeology** The study area lies immediately W-SW of Granard motte and bailey castle (LF010-080001), which was constructed in 1199 within the remains of a hillfort (LF010-080002), and is thought to have been the inauguration place (LF010-080003) of the O'Farrell clan in 1475. The monument survives as high, subcircular steep-sided mound of maximum 50m in diameter and 11m in height, with a large D-shaped bailey, with the remains of a later castle (LH010-080004) on the south-eastern perimeter.

A multitude of archaeological monuments are located within the wider landscape, the majority of which are medieval in origin and relate to the historic town of Granard (LF010-055). The following extract from the Archaeological Inventory for County Longford provides detail of all RMPs located within c.1km radius of the study area:

SMR	Class	Townland	ITM East	ITM North
LF010-051----	Ringfort - rath	Ballygilchrist	631578	781453
LF010-052----	Ringfort - rath	Balnagall	632181	781446
LF010-053----	Ringfort - rath	Granardkill	632002	781251
LF010-054001-	Ringfort - rath	Granardkill	632062	781017

SMR	Class	Townland	ITM East	ITM North
LF010-054002-	House - indeterminate date	Granardkill	632077	781024
LF010-055----	Historic town	Moatfield, Rathcronan, Granard, Granardkill	633219	780997
LF010-055001-	Church	Granard	632882	780901
LF010-055002-	Graveyard	Granard	632893	780880
LF010-056----	Castle - ringwork	Rathcronan	633409	781000
LF010-076----	Ringfort - rath	Ballybrien	631413	780065
LF010-077----	Ringfort - rath	Granardkill	631868	780819
LF010-078002-	Church	Granardkill	631966	780146
LF010-078004-	Graveyard	Granardkill	631966	780146
LF010-078005-	Souterrain	Granardkill	632084	780257
LF010-079----	Castle - motte	Granardkill	632295	780210
LF010-080001-	Castle - motte and bailey	Granard, Moatfield	632922	780729
LF010-080002-	Hillfort	Granard, Moatfield, Teemore	632935	780727
LF010-080003-	Inauguration site	Moatfield	632917	780761
LF010-080004-	Castle - unclassified	Moatfield	632919	780759
LF010-081----	Ringfort - rath	Granardkill	632555	780180
LF010-082----	Ringfort - rath	Rathcronan	633240	780340
LF010-084----	Ritual site - holy well	Cartron (Granard By.)	632535	780090
LF010-085----	Ringfort - rath	Teemore	633380	780073
LF010-086----	Ringfort - rath	Cartron (Granard By.), Rathcronan, Teemore	633444	779986
LF010-087----	Ringfort - rath	Cartron (Granard By.)	633200	779718
LF010-125----	Standing stone	Rathcronan	633580	780639
LF010-130----	Excavation - miscellaneous	Cartron (Granard By.)	633281	779543
LF010-131----	Enclosure	Rathcronan	633133	780558
LF010-132----	Excavation - miscellaneous	Rathcronan	633049	780701
LF010-138----	Battlefield	Rathcronan, Moatfield, Teemore, Granard, Granardkill, Grassyard, Churchquarter	633100	780900
LF010-140----	Enclosure - large enclosure	Granardkill	631927	781512

**Fieldwork** 4<sup>th</sup>-5<sup>th</sup> October 2019  
**Report issue** 13<sup>th</sup> November 2019  
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**Detection License No.** 19R0240  
**Client** Longford County Council  
**Geophysical technique** High-resolution magnetic gradiometry

## 1 SURVEY METHODOLOGY

### 1.1 Methodology

- 1.1.1 High resolution magnetic gradiometer survey was undertaken throughout the available lands within the study area, completing a total 8.5ha in parts of 2 fields (M1-M2), examining all lands suitable to geophysical investigation.
- 1.1.2 The survey employed an advanced multichannel fluxgate gradiometer system combined with cm precision GPS, recording magnetic gradiometer and GPS data simultaneously at rates of 75Hz and 1Hz respectively, conducting parallel instrument traverses 2.7m in width throughout M1-M2, with the instrumentation installed in tow configuration for use with an ATV.

### 1.2 Instrumentation

- 1.2.1 Details of the geophysical instrumentation employed for this survey are provided below:

Technique	Sensor spacing	Sample rate	Instrumentation	Sensitivity / precision	No. of measurements recorded
Magnetic (fluxgate) gradiometry	0.30m	75Hz	10 x Foerster Ferex CON650 Archaeology fluxgate gradiometers, 15 channel data logger	<75pT / $\sqrt{\text{Hz}}$ at 1Hz (650mm baseline)	836,784
GPS	3.00m	1Hz	Trimble R10 GPS (VRS)	<0.1m (vertical & horizontal)	12,224

- 1.2.2 For this geophysical survey the field instrumentation and software were configured to apply a spatial resolution of c.80-100 magnetometer gradiometer measurements per m<sup>2</sup> in accordance with the 'Level 3 – Characterisation' EAC Guidelines recommendation for geophysical survey in archaeology, (Schmidt et al, 2016).

### 1.3 Data processing

- 1.3.1 Post fieldwork magnetic gradiometer data processing was performed as follows:

Process	Description
a)	Positioning of magnetic gradiometer data based on real-time GPS measurements.
b)	Zero median transect processing for multi-sensor magnetometer data collected along parallel transects.
c)	Gridding (nearest neighbor interpolation).
d)	Export of georeferenced greyscale images at optimum range.

- 1.3.2 To ensure integrity of the processed geophysical data, and maintain close correlation with the original raw on-site measurements, no additional smoothing, low or high pass filters were applied proceeding steps a-d.

### 1.4 Data display

- 1.4.1 Figure 1 presents a site location diagram (scale 1:7500), highlighting the limits of the study W-SW of Granard motte and bailey castle, with RMPs in 1km proximity indicated.
- 1.4.2 Figure 2 presents a summary greyscale of the survey results from M1-M2 at a scale of 1:1500.

- 1.4.3 Figure 3 presents an interpretation of the results from survey in M1-M2 at a scale of 1:1500, with numbers included on the interpretation diagram referred to in the results section of this report.

## **2 GENERAL CONSIDERATIONS & COMPLICATING FACTORS**

### **2.1 Access & ground conditions**

- 2.1.1 Access throughout the study area was generally good, M1-M2 extending through SW facing pasture land free from major obstructions which might otherwise impede the progress of fieldwork.

### **2.2 Modern interference**

- 2.2.1 The results from survey in M1-M2 highlight numerous small-scale ferrous responses throughout. Ferrous responses are a common occurrence in magnetic survey data, and in most cases represent modern metal debris contained within the topsoil.
- 2.2.2 Broad ferrous responses are also apparent in the results. These generally occur at the perimeters of survey, mostly to the NE, in both M1 & M2. Large-scale ferrous to the NE in M2 derives from a permanent metal fence enclosing the Moatfield Reservoir and the access serving this Irish Water facility.
- 2.2.3 A band of magnetic disturbance traversing M1-M2 mostly NW-NE derives from high voltage overhead power lines. The potential that this magnetic disturbance may have masked subtle magnetic contrasts of archaeological significance, if present within the M1-M2, should not be dismissed.
- 2.2.4 A buried water main, visible as a strongly magnetic positive/negative linear response, extends NW-SE roughly parallel to the north-eastern edge of M2.

### 3 MAGNETIC GRADIOMETRY SURVEY RESULTS

#### 3.1 General overview

- 3.1.1 The results from magnetic gradiometer survey in M1-M2 display a relatively quiet magnetic background within a range of approximately  $\pm 1.5\text{nT}$ , which is punctuated by remnants of past cultivation, former/suspected former boundaries, localized variations in soil morphology/geology, and multiple small-scale ferrous responses.
- 3.1.2 The majority of responses deemed to be of archaeological potential have been recorded in the north-eastern portion of the study area in proximity to Granard motte and bailey castle. The discussion and likely provenance of these responses is provided below.

#### 3.2 M1

- 3.2.1 The data from survey in M1 are dominated by remnants of former/suspected former land divisions, past cultivation and magnetic disturbance caused by high voltage overhead power cables.
- 3.2.2 Linear responses and trends of potential significance concentrated to the NE in M1 may potentially represent part of an outlying network of enclosure remains or possible early field system associated with LH010-080001/LF010-080002. The most notable of these include anomalies 1-4, which are aligned roughly N-S and NE-SW. An archaeological interpretation for responses 1-4, however, remains cautious given that the historic mapping indicates 2 buildings in proximity to the north-eastern perimeter of M1. Several former boundaries also indicated on the historic mapping have been recorded in this portion of the study area. A possible recent origin for a number of the linear responses recorded to the NE in M1 should not be dismissed.
- 3.2.3 The results from survey to the NE in M1 also highlight a number of discrete strongly magnetic positives, the most notable of which include responses 5-7. These may represent pit remains and burnt/fired features of associated with LF010-080001/LF010-080002. An archaeological interpretation for anomalies 5-7 remains tentative however. Anomalies 5-7 may represent recent activity associated with the former buildings and disused boundaries which previously occupied this part of the study area.
- 3.2.4 Poorly defined responses of uncertain origin are also evident to the NE in M1. These include a large sub-circular response (8) c.16m in diameter, weakly magnetic responses 9-10, and multiple linear trends. The possible archaeological significance of these anomalies should not be ignored. However, the potential that 8-10 represent remains of former buildings and disused boundaries indicated on the historic mapping, natural soil/geological variations, and/or deeply buried modern ferrous source should also be considered.
- 3.2.5 A cluster of small-scale positives (11) at the south-western limit of M1 may be significant, potentially highlighting a number of pit type features. Interpretation of responses 11 remains cautious given the occurrence of natural soil/geological variation in this south-western portion of M1, and that these anomalies lie on the axis of a possible NW-SE former boundary not indicated on the historic mapping.
- 3.2.6 No further responses of note are indicated by the results from survey in M1.

#### 3.3 M2

- 3.3.1 The data from survey in M2 display remnants of former/suspected former land divisions, past cultivation and magnetic disturbance caused by high voltage overhead power cables. These responses generally correspond to the patterns of recent landuse and magnetic disturbance recorded from survey in M1.
- 3.3.2 A group of linear/rectilinear responses (12-13), similar in character to responses 1-4 (M1), have been recorded to the NE in M2. These anomalies are of NE-SW orientation, up to 50m in length, and suggest remains of an outlying enclosure or early field system associated with LF010-080001/LF010-080002. The pattern of these responses suggests a probable archaeological origin for anomalies 1-4 to the NE in M1.
- 3.3.3 Discrete positives also recorded to the NE in M2 may indicate potential pit locations or burnt/fired remains. The most notable of these include response 14 at the southern edge of linear anomaly 13, and strongly

magnetic positives 15-17 NE of survey centre in M2 and at the north-eastern survey limit. The possibility that 14-17 may derive from patterns of recent landuse, and/or deeply modern ferrous debris should not be ignored.

- 3.3.4 Further responses of potential note in the results from M2 include poorly defined shallow negative anomalies (18) SW of survey centre, and a discrete positive (19), possible pit, at the south-western limit of survey. Responses 18 correspond to an area of outcropping noted during fieldwork and likely derive from natural soil/geological variation.
- 3.3.5 No further responses of note are indicated by the results from survey in M2.

## 4 CONCLUSION

- 4.1 No responses of definite archaeological character have been recorded from geophysical survey within the study area. A sub-rectangular network of linear anomalies recorded to the NE in M1 and M2 suggests remains of a possible outlying enclosure or early field system associated with LF010-080001/LF010-080002. Poorly defined anomalies, trends, and strongly magnetic positives of potential interest are also indicated by the results from survey to the NE in M1-M2. The possible significance of these responses should not be ignored. However, the historic mapping for the area indicates the locations of 2 former buildings c.10-15m beyond the north-eastern perimeter of M1 and several former boundaries. Consequently, interpretation of the responses recorded from survey in the north-eastern portion of M1 has been made difficult, and a possible recent origin for a number of the anomalies in M1 has been suggested.
- 4.2 The results from survey in M1-M2 also highlight several potential pit/burnt fired features in M1-M2 both to the NE and SW. A possible modern ferrous origin for these anomalies should not be discounted.
- 4.3 Elsewhere, the results from survey highlight patterns of former landuse, as indicated by remnants of disused boundaries and past cultivation extend throughout the study area. Large-scale magnetic disturbance from high voltage overhead power cables traverses the results from M1-M2 NW-SE and the potential that this may have masked subtle contrasts of potential significance should not be ignored.

## BIBLIOGRAPHY

Schmidt A, (2002), Archaeology Data Service. Geophysical Data in Archaeology. A guide to good practice.

Schmidt A, Linford P, Linford N, David A, Gaffney C, Sarris A, and Fassbinder J, (2016), EAC Guidelines for the Use of Geophysics in Archaeology.

## ONLINE RESOURCES

Archaeological Survey of Ireland SMR Database

<http://webgis.archaeology.ie/historicenvironment/>

National Monuments Service, Department of Arts, Heritage, regional, Rural & Gaeltacht Affairs.

Geological Survey of Ireland Spatial Resources, Public Data Viewer Series

<https://dceur.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aac3c228>

Irish National Soils Map, 1:250,000k, V1b (2014). Teagasc, Cranfield University. Jointly funded by the EPA STRIVE Research Programme 2007-2013 & Teagasc. <http://gis.teagasc.ie/soils/map.php>



## LIST OF FIGURES

Fig. 1	Site location	1:7500
Fig. 2	Greyscales M1-M2	1:1500
Fig. 3	Interpretation M1-M2	1:1500

## APPENDICES

Technical Information: Magnetometry

**MAGNETOMETRY**

**Introduction**

Magnetometry represents one of a suite of geophysical techniques employed in archaeological prospection to inform invasive investigations such as trial trenching and excavation.

Frequently used to determine the often non-visible boundaries of archaeological remains, magnetometer surveys enable archaeologists to identify the location, form and extent of a diverse array of archaeological features no longer visible at the surface.



1. Advanced multi-channel magnetometer survey mapping the buried foundation of a 14th century castle (towed configuration with ATV).

Buried archaeological remains successfully identified using magnetometry include sites such as enclosure systems and deserted villages, hillforts and military encampments, henges and tumuli, villa/castle foundations, and ecclesiastical settlements.

**Background to application**

The basis for use of magnetometry in archaeological prospection derives from the abundance of natural iron oxides in most soils, and our ability to measure subtle variations in the magnetic properties of these iron oxides caused by human activity. Discrete variations in soil magnetism associated with buried archaeological remains derive typically from in situ burning and organic enrichment of the soil, through activities such as cooking and heating; pottery manufacture and metal working; as well as use of fired building materials such as ceramic tiles and brick. These burnt, fired and organic rich deposits create subtle magnetic contrasts visible as discrete magnetic anomalies superimposed on the earth’s geomagnetic field.



2. Results from magnetometer survey presented in greyscale format highlighting pit remains bordering an enclosure site and Roman villa.



3. Burnt & fired debris revealed following excavation of pit remains bordering an enclosure site and Roman villa.

Magnetometer surveys conducted in both commercial and research archaeological investigations enable determination of the location, form and extent of buried archaeological remains. Data acquired from these surveys can be quickly generated into georeferenced images and interpretation layers to inform subsequent trial trenching and excavation.

**Technology**

TARGET provides precise mapping and characterization of buried archaeological remains by employing an array of highly stable and sensitive fluxgate gradiometers, combined with an advanced data logging system and cm precision GPS. This state-of-the-art geophysical instrumentation, which is capable of collecting extremely dense data sets, permits detailed high resolution survey of archaeological sites from as small as 1ha in size, to larger scale investigation of sites up to 150ha or more.



4. Advanced multi-channel gradiometer system for magnetometer survey (manual configuration).



5. GPS tracks (red) highlighting lines of data collection & results from magnetometer fieldwork at a suspected burial ground.

TARGET undertakes high resolution magnetometer surveys as standard, recording data at c.5cm intervals with probe separations of 0.28m or 0.5m, for precise measurement and characterization of buried archaeological remains.

**Data Display**

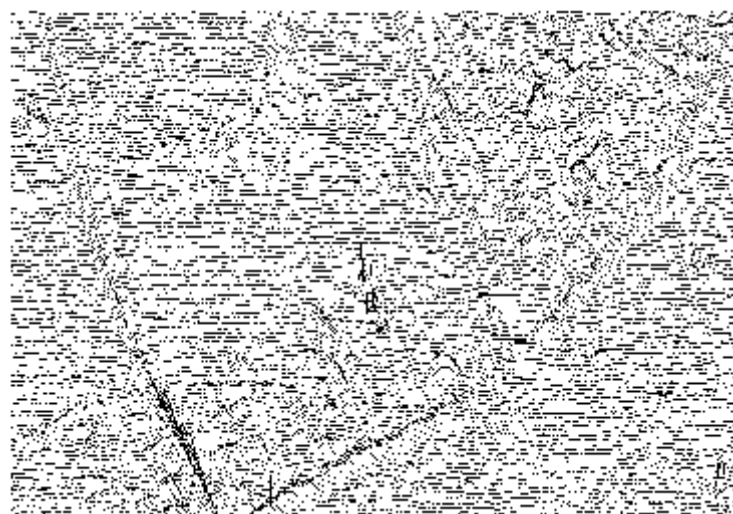
*Greyscale* plots are the most common format for displaying magnetometer data. This display format assigns a cell to each datum according to its location on the grid. The display of each data point is conducted at very fine increments, allowing the full range of values to be displayed within a given data set. This display method also enables the identification of discrete responses barely visible above natural 'background' magnetic variation on site.

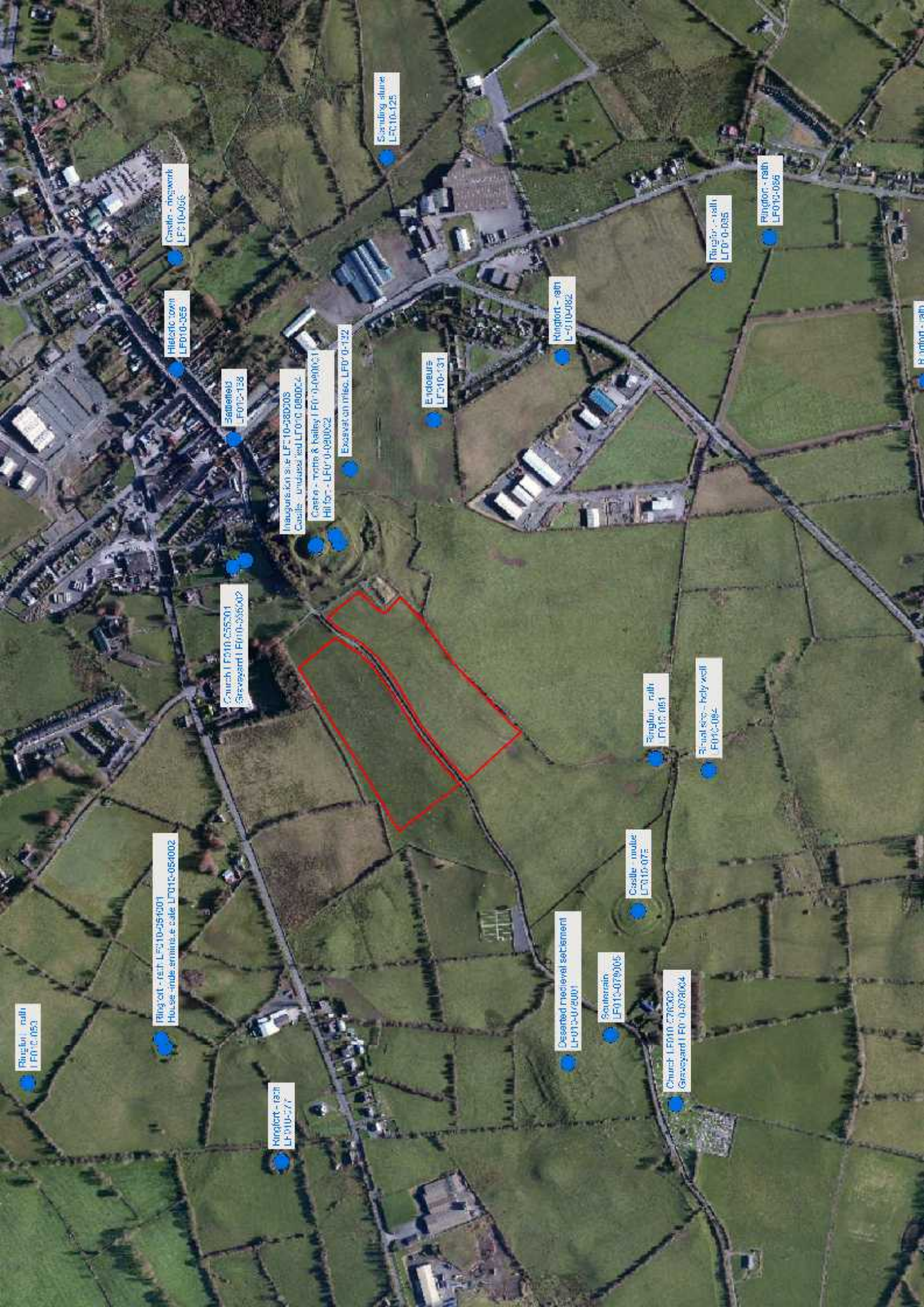
6. Greyscale from survey at the site of a deserted medieval village.



*XY trace* plots provide a near-perspective representation of measurements along individual lines of data recorded from each of the magnetometer sensors. The XY trace format is used as a conventional method for identifying responses which derive from modern ferrous debris. The XY trace display is particularly when identifying magnetically strong anomalies indicative of buried hearths, kilns and furnaces.

7. XY trace from survey at the site of a deserted medieval village.





Ringfort - rath  
LF010-053

Ringfort - rath LF010-051001  
House - rath, rath, rath, rath LF010-054002

Ringfort - rath  
LF010-277

Church LF010-055001  
Graveyard LF010-056002

Ballinabally  
LF010-138

Inauguration site LF010-080005  
Castle - rath LF010-080002  
Caern - rath & rath LF010-080001  
Hill fort - LF010-080002

Excavation site LF010-122

Standing stone  
LF010-125

Enclosure  
LF010-131

Disused medieval settlement  
LF010-072001

Scutcherin  
LF010-073005

Church LF010-076002  
Graveyard LF010-078004

Castle - rath  
LF010-075

Ringfort - rath  
LF010-081

Well site - holy well  
LF010-084

Ringfort - rath  
LF010-082

Ringfort - rath  
LF010-085

Ringfort - rath  
LF010-086

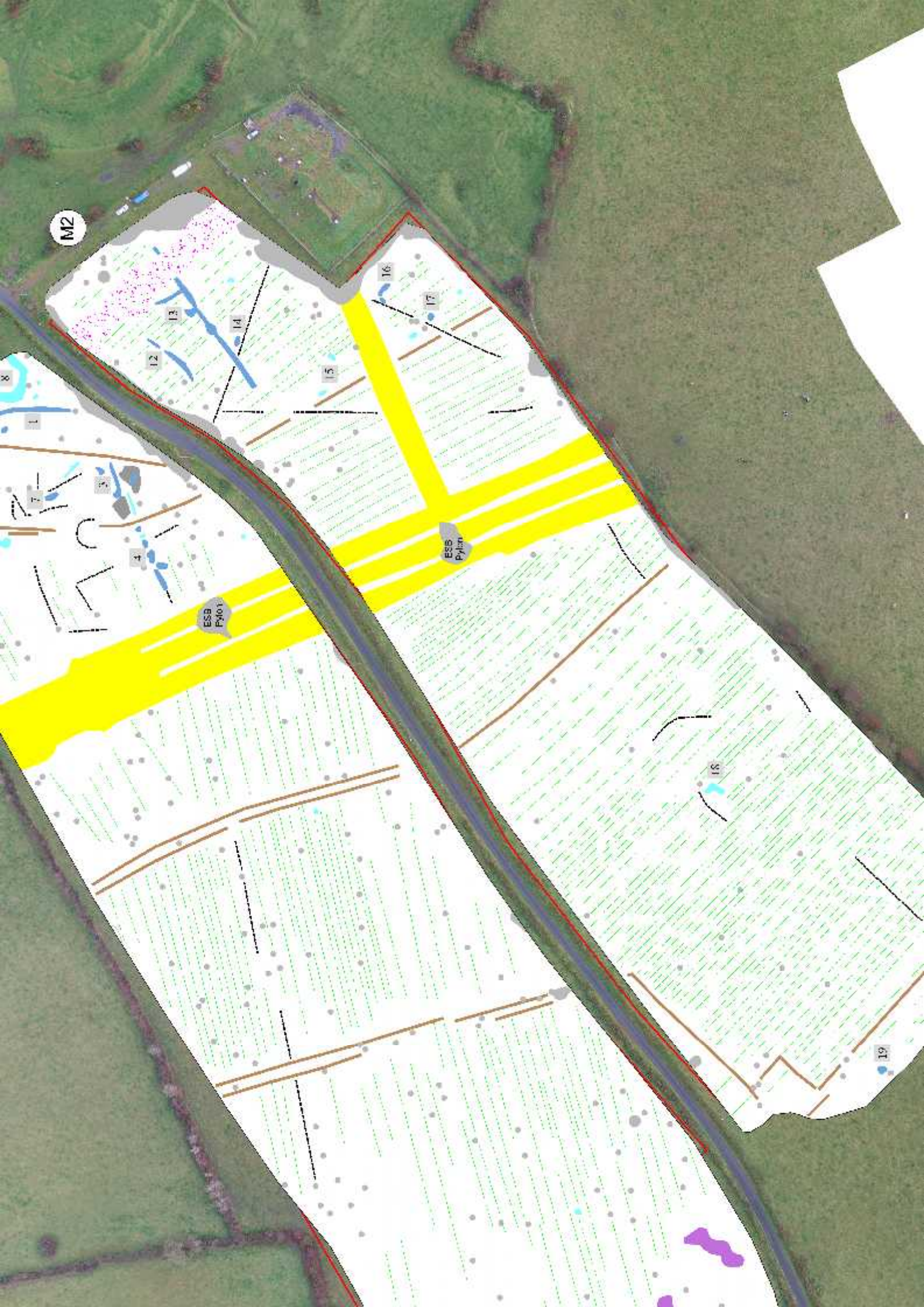
Castle - ringfort  
LF010-095

Historic town  
LF010-355

Ringfort - rath



M2



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