AECOM

Shannon Technology and Energy Park (STEP) Power Plant

Appendix A12.5: Geophysical Survey Report

Shannon LNG Limited

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TARGET

Archaeological Geophysics

Geophysical Prospection For Archaeological Assessment

Consultancy

Project Design

Scanning & Reconnaissance

Recorded Survey

Gradiometry

Resistivity

Ground Penetrating Radar

Electromagnetics

Motorway Route Selection

Pipeline Corridors

Area Surveys

Research

Geophysical Survey Report:

Ballylongford
County Kerry

Licence: 06R0167

TAG Project No. 06/044

Client:

SHEILA LANE & ASSOCIATES
CONSULTANT ARCHAEOLOGISTS

Deanrock Business Park,
Togher, Cork.
Tel: (0)21 480 8155
Fax: (0)21 4809043
Email: sheila_lane@iol.ie

ΣΛ

On Behalf Of

ARUP Consulting Engineers

TARGET Archaeological Geophysics
Geophysical Prospection For Archaeological Assessment

Apartment 25
Block 11
Gallery Quay
Dublin 2

Mobile: +353 (0)87 858 0112
Telephone & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

List Of Figures

Executive Summary

Introduction

Geophysical survey was undertaken in the townlands of Carhoonakineely, Kilcolgan Lower and Ralappane, near Ballylongford, in County Kerry. The survey focused on four sections of land situated within the proposed Shannon LNG: Tarbert / Ballylongford Terminal development site, which is situated approximately 4.5 kilometres due west of Tarbert, on the edge of the Shannon estuary. This work was commissioned by Sheila Lane & Associates (Consulting Archaeologists) on behalf of ARUP Consulting Engineers & Shannon LNG, and forms part of the ongoing archaeological assessment relating to the proposed development.

Survey Objectives

The objectives of survey were to determine the location and extent of buried archaeological remains, where present, within eight areas of archaeological potential highlighted from aerial photographic survey, field inspection and cartographic research. The areas of archaeological potential include one possible archaeological feature noted during the preliminary geological survey (A); five potential sites identified during aerial photographic survey (B, C, D, E & F); the western zone of archaeological potential for rath site RMP KE003:004 (G); and one potential site identified during the field inspection (H).

Site Location

The area of proposed development is bound to the north by the Shannon Estuary and to the south by a minor road extending between Ballylongford and Tarbert. The eastern and western limits of the site are defined by agricultural land. The areas of geophysical investigation comprise four sections of land in the western, north-western, north-eastern and southern regions of the assessment study area. Potential sites A, B, C, F & G form the north-eastern section of investigation (NGR 102619 148756). D, E and H are located in north-western, western, and southern remaining areas for geophysical survey (NGR 101280 148198, NGR 101664 14858, and NGR 102204 147867).

Soils & Topography

The areas of investigation are situated within gently rolling and level pasture land, the majority of which faces the estuary shoreline. Soils specific to the region include a

predominant acid brown earth, with gleys and peaty gleys occurring locally. The underlying bedrock derives from Upper Carboniferous shale and sandstone glacial till.

Archaeological Background

The areas of archaeological potential highlighted from the recent assessment studies include Area A, an oval-shaped area of rough ground identified during the geological survey in the north-eastern section of the site; Area B, a possible rectangular feature observed to the north-east during the aerial photographic survey; Areas C, D, E & F, a number of circular features and one semi-circular area, observed from aerial photographic survey in the north-western, southern, and north-eastern site regions; and Area H, a semi-circular shaped mound noted to the west during the field inspection. The area of archaeological potential for recorded monument KE003:004 lies at the north-eastern section of the proposed development. This site is described as a levelled rath for which there is no above ground evidence. The area of archaeological potential for this monument has been highlighted as site G in the assessment report.

Recorded monuments within a 2 kilometre radius of the proposed development include rath and earthwork sites KE003:003, KE003:005, KE003:006 in Carhoonakineely townland to the north-east and east; rath sites KE003:014, KE003:015 & KE003:017 in Reenturk, Kilcolgan Upper and Clancullare North townlands to the south-west and south; standing stone site KE003:020 in Glansillagh townland to the south-east; and fulacht fiadh and enclosure sites KE003:06501 & KE003:06502 in Kilcolgan Lower to the south-west.

Summary Of Results

Significant responses identified from the geophysical survey have been recorded in the location of potential site H (Area 1), to the west, and to the north-east, in Area 8 & Area 17 (Area 17: known site G). The detailed survey in Areas 1 & 8 show evidence for concentrations of suspected burnt / fired material, which may reflect remains associated with fulacht fiadh / burnt mounds sites or similarly enhanced archaeological deposits. The responses recorded in Area 17 are thought to reflect part of the enclosing ditch and internal remains associated with recorded monument KE003:004 site G.

The locations of several possible recent buildings / structures are indicated in Areas 6, 10 & 13. No further areas of definitive archaeological response have been recorded to suggest that areas of settlement activity or significant archaeological features are present within the

locations of potential sites A, B, C, E & F. Elsewhere the data show evidence for intense cultivation throughout much of the north-eastern investigation area with significant levels of boundary removal also having occurred. Areas of natural variation in response are also apparent in the results from survey.

*** This summary should be read in conjunction with the results from detailed survey.**

1 Areas of Investigation *(Figure 1)*

1.1 A total 3.0 hectares of detailed gradiometer survey centred on potential sites H, D & E was undertaken in the western, north-western and southern areas of investigation, in Area 1, Area 2 & Areas 3 – 5 respectively. A further 16 hectares of gradiometer scanning was carried out across the north-eastern section of investigation over potential sites A, B, C, G & F. On the basis of the results from the initial scan of this area 3.63 hectares of targeted detailed gradiometer survey was carried out in twelve areas (Areas 6 – 17).

1.2 The survey grids for detailed investigation were tied-in to the National Grid using differential GPS. Tie-in points have been left in situ to facilitate grid relocation where necessary.

1.3 Fieldwork was undertaken between 3rd – 10th October 2006 under licence from the Department Of Environment, Heritage & Local Government (Licence No. 06R0167).

1.4 Figure 1 presents the site location to the west of Tarbert at scales of 1:50,000 & 1:6500, and highlights the locations of detailed survey Areas 1 – 5 in the western, north-western and southern sections of the site, and shows the results from scanning and positions of detailed survey Areas 6 – 17 to the north-east. The locations of RMP KE003:004 and the remaining monuments within a 2 kilometre radius of the site are detailed on Figure 1, as are the potential sites identified during the assessment.

2 Data Display

2.1 The results from detailed survey in Areas 1 – 16 are presented as summary greyscale images and accompanying interpretation diagrams presented in Figures 2 - 7 at a scale of 1:2500.

2.2 Figures 8 - 33 display the results from detailed survey in Areas 1 – 16 as a series of XY trace and greyscale plots, with accompanying interpretation diagrams, all displayed at a scale of 1:500.

2.3 The display formats referred to above are discussed in the *Summary Technical Information* section attached to this report.

3 Ground Conditions & General Considerations

3.1 Ground conditions at the site were generally suitable for survey, the majority of the survey area comprising pasture land free from obstruction. Detailed survey was precluded in Areas 5 & 8, in the southern and north-eastern regions of investigation, due to dense gorse and scrub.

3.2 Isolated ferrous-type responses are apparent throughout the data. These anomalies are usually caused by the presence of modern ferrous debris within the topsoil and are not referred to in the text unless considered relevant. Several broad concentrations of ferrous response, notably in Areas 1, 3, 4, 5, 9 & 15, are apparent in the data, and these represent interference from metal fencing, adjacent boundaries, disused buildings or structures, and concentrations of modern ferrous debris noted during fieldwork.

3.3 Instrument specifications and survey methodology are discussed in the *Summary Technical Information* document attached to this report.

4 Results From Gradiometer Scanning, North-Eastern Investigation *(Figure 1)*

4.1 A total 16ha of land situated within the north-eastern section of the site was subjected to a preliminary gradiometer scan to identify, where possible, any remains associated with RMP KE003:004 (Site G), and to determine the significance of potential sites A, B, C, & F. The scan was undertaken employing two gradiometers operating in tandem, in order to observe any significant fluctuations in instrument response whilst traversing the investigation area at 10m intervals. Where significant responses occurred, these were examined in closer detail, their locations referenced to the national grid using differential GPS, and the anomalies subsequently selected for further examination by detailed recorded survey.

4.2 In general, a high level of background variation was observed throughout the north-eastern investigation area. A multitude of responses were noted, and these tended to extended north-west to south-east throughout each field. The majority of responses occurred as strong parallel positive / negative linear anomalies at the +5/-4nT range, and these were thought to represent former cultivation regimes and disused boundaries. Regions of suspected natural variation in the underlying soil and bedrock occurred sporadically throughout this section of the proposed development.

4.3 Several potentially significant anomaly concentrations occurred over sections of elevated ground in the approximate centre and western extremity of this section of the site. The remains of several possible recent buildings or structures were also noted in these locations, though none appeared to coincide with the locations of potential sites A, B, C, & F.

4.4 Twelve areas of sample detailed recorded survey were undertaken in this north-eastern section of investigation (Areas 6 - 17). These were positioned to examine the archaeological potential of sites A, B, C, G & F, and to clarify the nature of the responses noted during the scan.

5 Results From Detailed Survey, *(Summary Figures 2 – 7; Archive Figures 8 - 33)*

5.1 Area 1, Western Investigation, Centered Over Potential Site H

5.1.1 The results from survey in Area 1 show the location of a broad sub-circular region of strong magnetic disturbance bound to the north-west by an area of increased magnetic response. These anomalies coincide with the semi-circular shaped mound detailed in the assessment report as potential site H. The responses indicate the presence of a concentration of burnt or fired material extending over an area *c.*20m in diameter across the western section of the survey block. These anomalies and are deemed to be of potential archaeological interest, possibly representing the location of a burnt mound / fulacht fiadh site or similarly intensive firing activity. The possibility that these responses may represent deposits of more recent ferrous origin should not be dismissed.

5.1.2 Two further areas of increased magnetic response have been located along the north-eastern edge of Area 1. These may also be of archaeological interest, although the absence of any clear archaeological context here suggests a natural origin should not be dismissed. Evidence for natural soil and / or geological intrusions in the data set is apparent as a band of fragmented and irregular positive responses extending from the north-eastern survey edge.

5.1.3 A number of faint linear trends and isolated areas of positive response have also been recorded in Area 1. These anomalies may be significant although, the lack of any clear archaeological patterns here suggests they may represent more recent ploughing activity and / or natural variations in the underlying soil / bedrock.

5.2 Area 2, North-Western Investigation, Centered Over Potential Site D

5.2.1 The results from detailed survey in Area D indicate intensive cultivation activity and remnants of probable former land divisions. The former is visible as a series of closely spaced parallel linear anomalies aligned approximately north to south. The remains of the suspected former boundary ditches are visible extending from the western edge of the survey block and approximately across its centre east to west. Two further weak linear have been recorded to the north-east and south. These are at the limits of instrument detection. A more recent landuse / agricultural source for these anomalies is suggested.

5.2.2 No clear archaeological type patterns suggesting significant archaeological remains associated with potential site D are apparent within the results from survey in Area 2.

5.3 Areas 3, 4 & 5, Southern Investigation, Centered Over Potential Site E

5.3.1 The results from survey over potential site E demonstrate further interference from ploughing regimes (Area 5), and intrusions into the data set from the subsoil and underlying geology (Areas 3, 4 & 5). One fragmented linear response has been recorded extending approximately north to south from the north-western edge of survey Area 5. This response is thought to reflect part of a former boundary or cultivation ridge.

5.3.2 No significant archaeological patterns which might coincide with potential site E are apparent in the results from detailed survey Areas 3, 4 & 5. Several weak trends and isolated anomalies have also been recorded. The lack of any clear archaeological context to these suggests they are likely to reflect remains of former cultivation, natural variation, or deeply buried modern ferrous material.

5.4 Areas 6 – 17, North-Eastern Investigation, Extending Over Potential Sites A, B, C, G & F, & A Selection Of Anomalies Observed During Scanning

5.4.1 The majority of anomalies noted during the initial scanning over the north-eastern section of investigation appear to reflect former cultivation regimes, and these are represented by concentrations of closely spaced parallel linear responses aligned north-west to south-east (Areas 6- 9, 11, 12, 14 - 17), and north-east to south-west (Area 6). The proximity of underlying geology in this section of the site is thought to have contributed to the intense variation in the results. The possibility that areas of potential archaeological significance of a more subtle nature may have been masked by this enhanced variation should not be dismissed. Three probable boundaries demarcating this former cultivation have been recorded in Areas 6 & 11, and are visible as a negative linear anomaly and three positive linear responses extending across part of each survey block.

5.4.2 The results from survey in Area 8 show the location of a region of strong magnetic disturbance measuring *c.*20m in diameter, overlain with a broad region of positive enhancement. These anomalies are bound to the north-west by an area of increased magnetic response, and are collectively thought to indicate an area of intense burning / firing activity. The possibility that these responses may indicate the site of a fulacht fiadh / burnt mound or similar fired / burnt remains should not be dismissed. However, a natural or modern origin for this concentration of responses cannot be entirely dismissed.

5.4.3 The results from Areas 6, 10 & 13 show the locations of several irregular areas of strong magnetic disturbance, the majority of which appear to coincide with locations of outcropping geology and sections of elevated ground. The remains of several possible recent buildings or

structures were noted in each of these areas during scanning. Low-level trends, linear responses and isolated anomalies have been recorded in each of these survey blocks. Collectively these responses do not adhere to any clearly recognisable archaeological patterns. However, they are deemed to be worthy of further investigation.

5.4.4 A fragmented and positive curvi-linear response recorded in the northern section of Area 17 may reflect part of the enclosure ditch associated with recorded monument KE003:004 (Site G). Traces of a possible rectangular feature are visible at the northern edge of this survey block, possibly reflecting further remains associated with the recorded monument. However, interpretation remains tentative in view of the extent of natural variation in this location of survey. Several isolated pit type responses have also been recorded in this location.

5.4.5 No significant anomalies which might indicate remains associated with potential sites A, B, C & F have been recorded from detailed survey in this north-eastern section of the proposed development.

6 Conclusions

6.1 The geophysical survey undertaken within the western, north-western, southern and north-eastern sections of the proposed development has highlighted the locations of several potentially significant responses. The most significant of these include concentrations of suspected burnt / fired material, in detailed survey Areas 1 & 8, possibly associated with fulacht fiadh or burnt mound remains; and a fragmented response and rectangular arrangement of low-level anomalies in Area 17, which are thought to be associated with the enclosing ditch of levelled rath site KE003:004 (site G), and its internal remains. The possible suspected burnt / fired remains recorded in Area 1 coincide with potential site H.

6.2 Regions of strong magnetic disturbance recorded in detailed survey Areas 6, 10 & 13 coincide with sections of elevated ground in the north-eastern investigation. These areas of response may be worthy of further examination, although they are thought to reflect possible recent structures or buildings overlying areas of natural outcropping.

6.3 No definitive archaeological remains which clearly indicate significant archaeological features associated with potential sites A, B, C, E & F have been recorded. It is possible that buried archaeological features, if present in these areas, may be beyond the limits of instrument detection. However, the range of background variation at the site suggests that the soils and geology have sufficient enhancement capacity for areas of archaeological settlement or concentrations of significant remains to exhibit a detectable magnetic contrast.

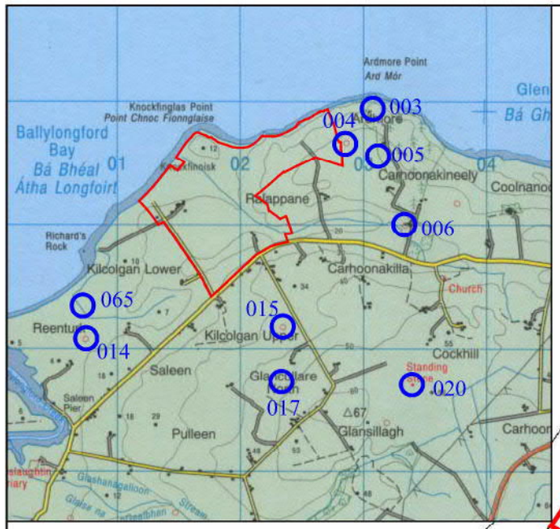
6.4 Elsewhere the data illustrate that much of the land contained within the four geophysical investigation areas has been intensely cultivated in recent years. It also suggested that significant boundary removal has also occurred.

Report Author:	John Nicholls MSc.
Personnel:	John Nicholls MSc. & Dan Shiel BSc.
Date of Survey:	3rd – 10th October 2006
Date of Report:	20th October 2006

References:

National Soil Survey Of Ireland (1980), *General Soil Map 2nd Edition (1:575,000. An Foras Taluntais).*

O'Leary, M. (2006), *Archaeological Assessment, Ballylongford, County Kerry.* Unpublished Report, Sheila Lane & Associates.



1/50000 @ A3

1/6500 @ A3

1 DETAILED SURVEY

GRADIOMETER SCANNING

ARCHAEOLOGICAL STUDY AREA

005 RMP SITE

A POTENTIAL SITE

SCANNED ANOMALIES

GPS TIE - INS

N

0 METRES 300

BASED ON MAPPING PROVIDED BY THE CLIENT

TARGET Archaeological Geophysics

Geophysical Prospection For Archaeological Assessment

Apartment 25
Block 11
Gallery Quay
Dublin 2

Mobile +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

PROJECT:
BALLYLONGFORD, CO. KERRY

TITLE:
SURVEY LOCATION:
GRADIOMETER SCANNING
& DETAILED
GRADIOMETRY AREAS 1 - 17

LICENCE: 06R0167

JOB NUMBER: 06/044

CLIENT:
SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS

FIGURE:	DATE:	SCALE:
FIG. 1	20/10/06	1/6500 @ A3

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KILCOLGAN LOWER

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1 DETAILED SURVEY

ARCHAEOLOGICAL STUDY AREA

N

0 METRES 100

BASED ON MAPPING
PROVIDED BY THE CLIENT

TARGET Archaeological Geophysics

Geophysical Prospection For Archaeological Assessment

Apartment 25
Block 11
Gallery Quay
Dublin 2

Mobile +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

PROJECT:
BALLYLONGFORD, CO. KERRY

TITLE:
SUMMARY GREYSCALE:
DETAILED SURVEY AREAS 1 & 2

LICENCE:
06R0167

JOB NUMBER:
06/044

CLIENT:
SHEILA LANE & ASSOCIATES ON BEHALF OF
ARUP CONSULTING ENGINEERS

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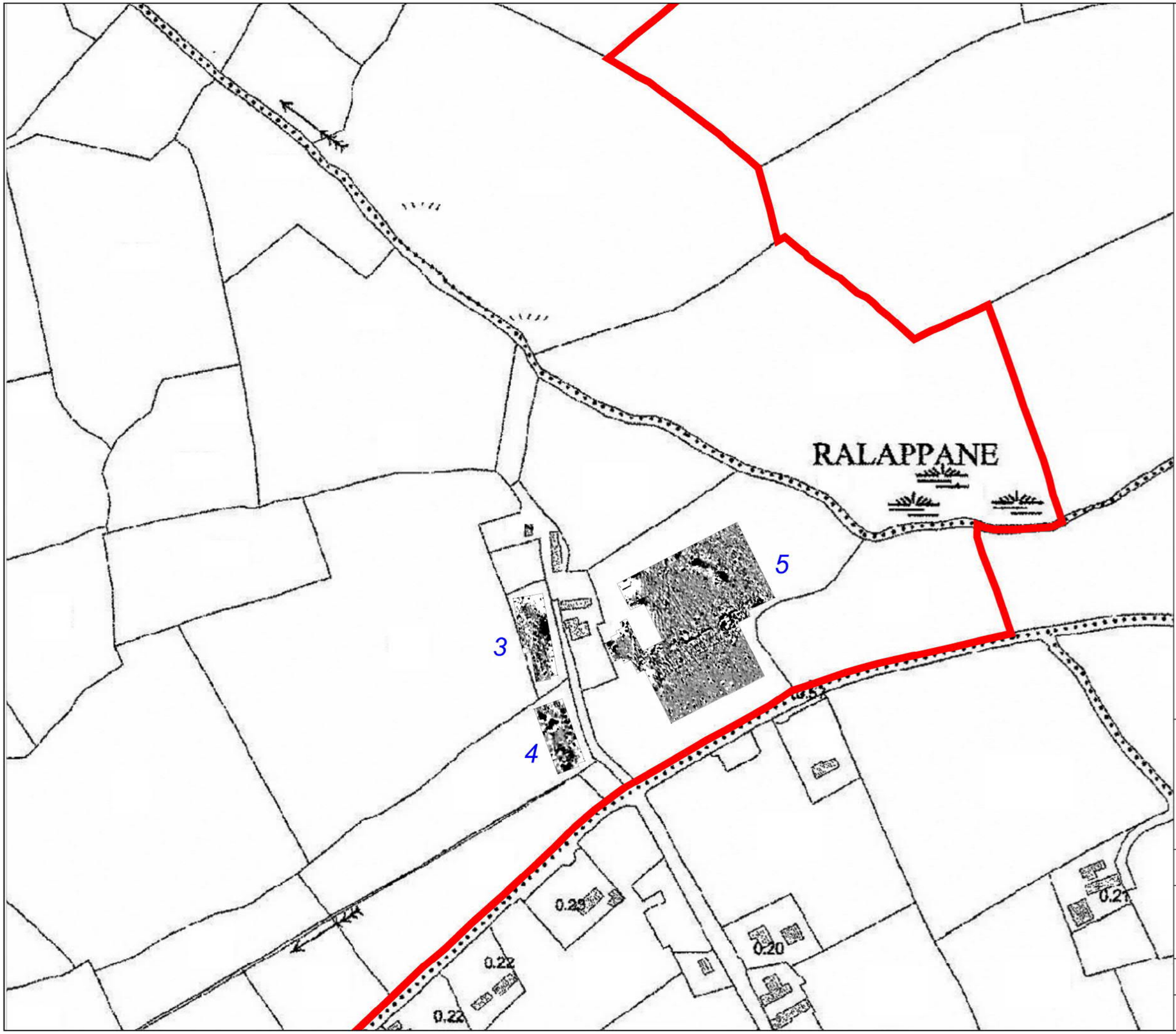

2.0
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1 DETAILED SURVEY

ARCHAEOLOGICAL STUDY AREA

N

0 METRES 100

BASED ON MAPPING PROVIDED BY THE CLIENT

TARGET Archaeological Geophysics

Geophysical Prospection For Archaeological Assessment

Apartment 25
Block 11
Gallery Quay
Dublin 2

Mobile +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

PROJECT:
BALLYLONGFORD, CO. KERRY

TITLE:
SUMMARY GREYSCALE:
DETAILED SURVEY AREAS 3 - 5

LICENCE:
06R0167

JOB NUMBER:
06/044

CLIENT:
SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS

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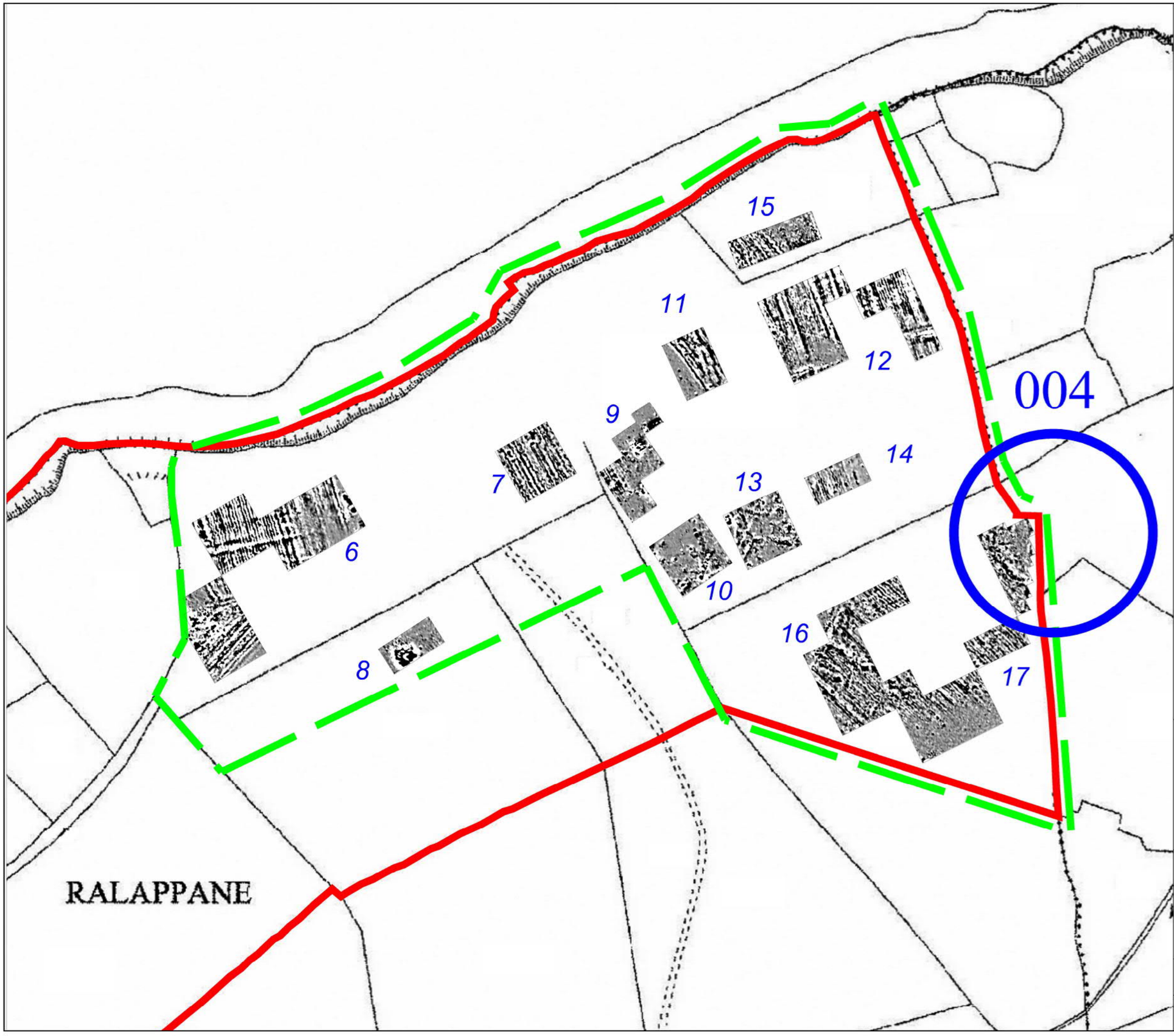

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1 DETAILED SURVEY

GRADIOMETER SCANNING

ARCHAEOLOGICAL STUDY AREA

005 RMP SITE

N

0 METRES 100

BASED ON MAPPING PROVIDED BY THE CLIENT

TARGET Archaeological Geophysics

Geophysical Prospection For Archaeological Assessment

Apartment 25
Block 11
Gallery Quay
Dublin 2

Mobile +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

PROJECT: BALLYLONGFORD, CO. KERRY

TITLE: SUMMARY GREYSCALE: DETAILED SURVEY AREAS 6 - 17

LICENCE: 06R0167

JOB NUMBER: 06/044

CLIENT: SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS

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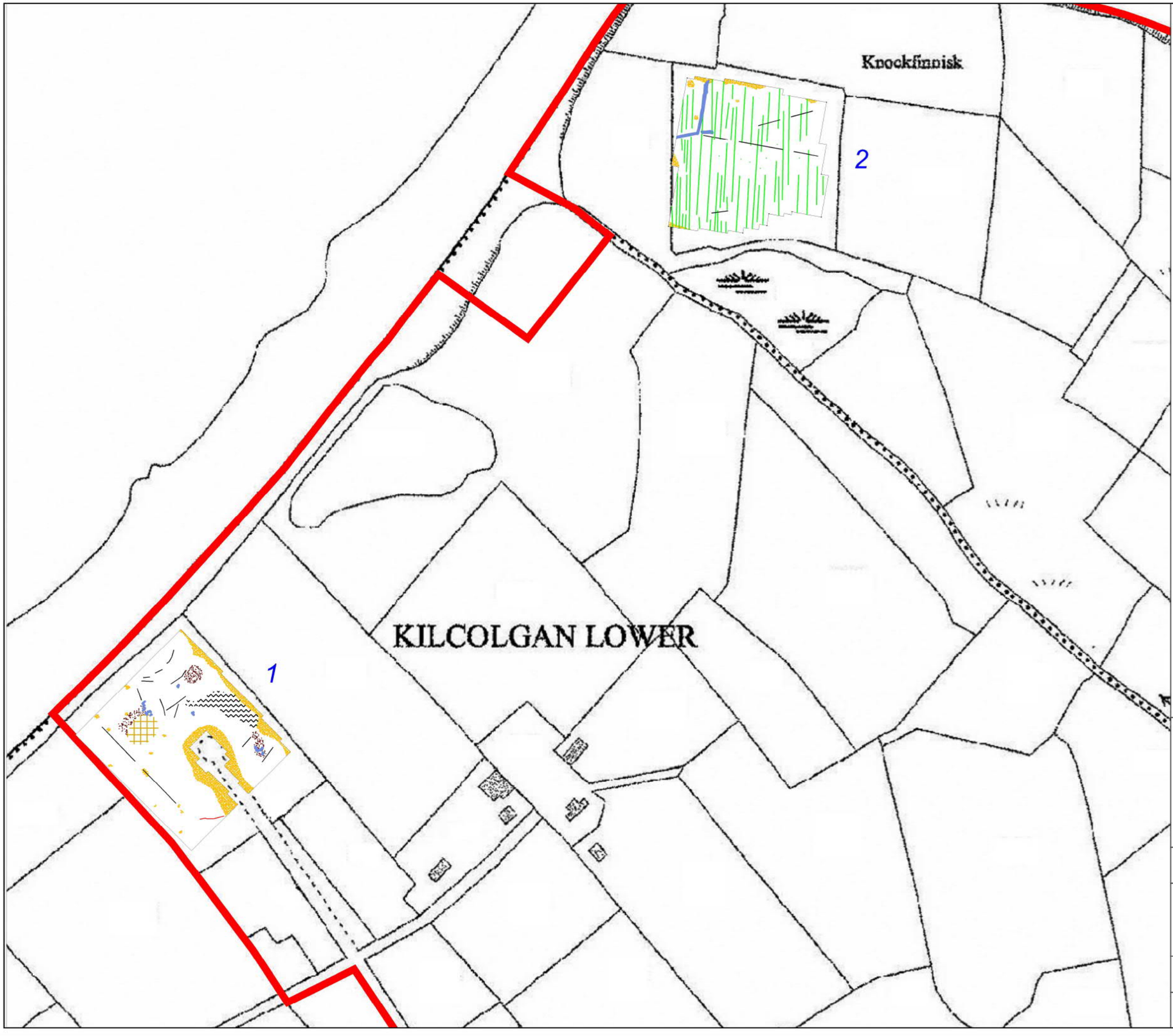


? Archaeology

Area Of Increased Magnetic Response

Area of Magnetic Disturbance

Trend

Negative Trend

Cultivation

Natural

Ferrous

1 Detailed Survey

Archaeological Study Area

N

0 METRES 100

BASED ON MAPPING PROVIDED BY THE CLIENT

TARGET Archaeological Geophysics

Geophysical Prospection For Archaeological Assessment

Apartment 25
Block 11
Gallery Quay
Dublin 2

Mobile +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

PROJECT:
BALLYLONGFORD, CO. KERRY

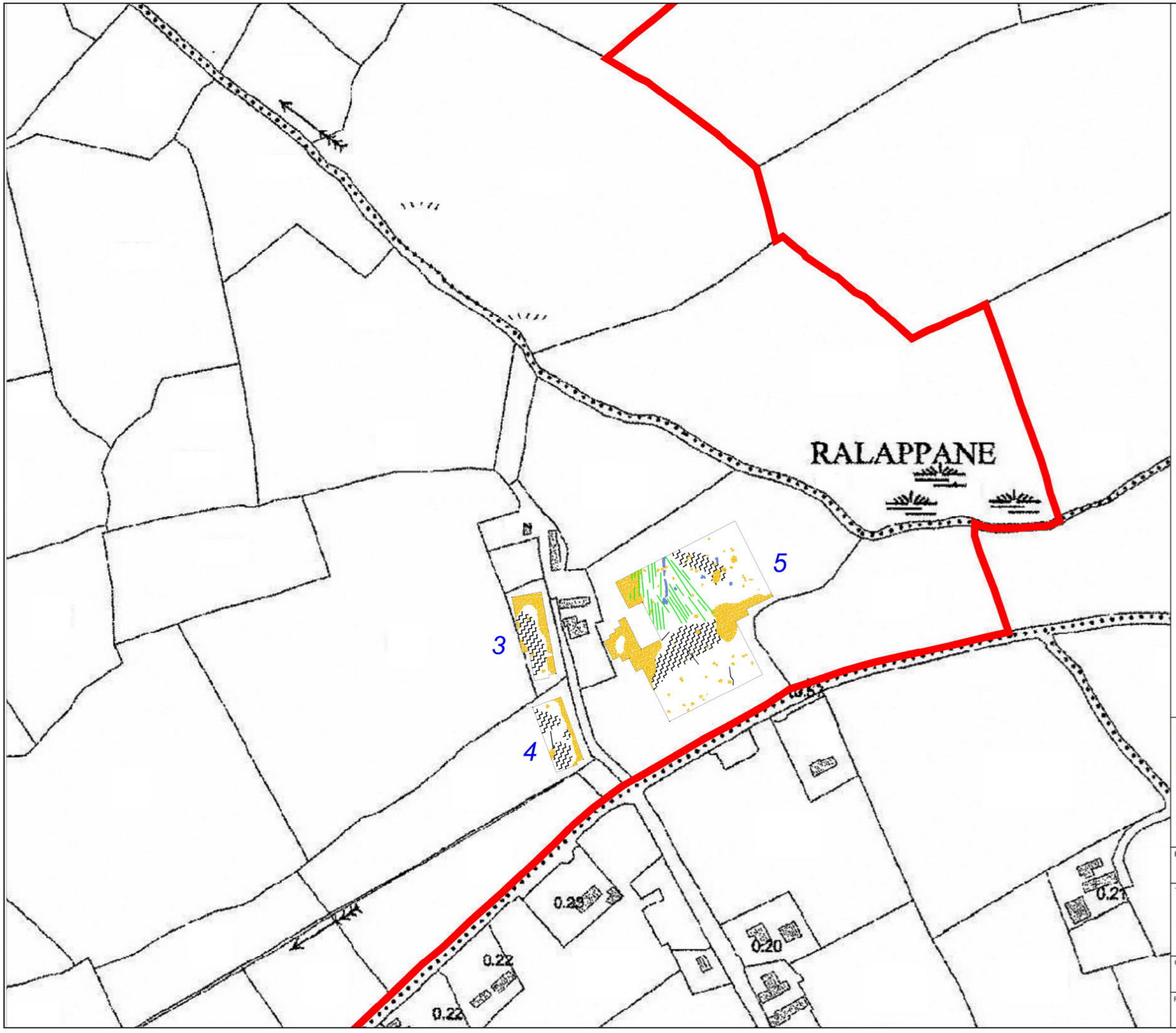
TITLE:
SUMMARY INTERPRETATION: DETAILED SURVEY AREAS 1 & 2

LICENCE: 06R0167

JOB NUMBER: 06/044

CLIENT:
SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS

FIGURE:	DATE:	SCALE:
FIG. 5	20/10/06	1/2500 @ A3



? Archaeology

Trend

Cultivation

Natural

Ferrous

1 Detailed Survey

Archaeological Study Area

BASED ON MAPPING
PROVIDED BY THE CLIENT

TARGET Archaeological Geophysics

Geophysical Prospection For Archaeological Assessment

Apartment 25
Block 11
Gallery Quay
Dublin 2

Mobile +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

PROJECT:
BALLYLONGFORD, CO. KERRY

TITLE:
SUMMARY INTERPRETATION:
DETAILED SURVEY AREAS 3 - 5

LICENCE:
06R0167

JOB NUMBER:
06/044

CLIENT:
SHEILA LANE & ASSOCIATES ON BEHALF OF
ARUP CONSULTING ENGINEERS

FIGURE:	DATE:	SCALE:
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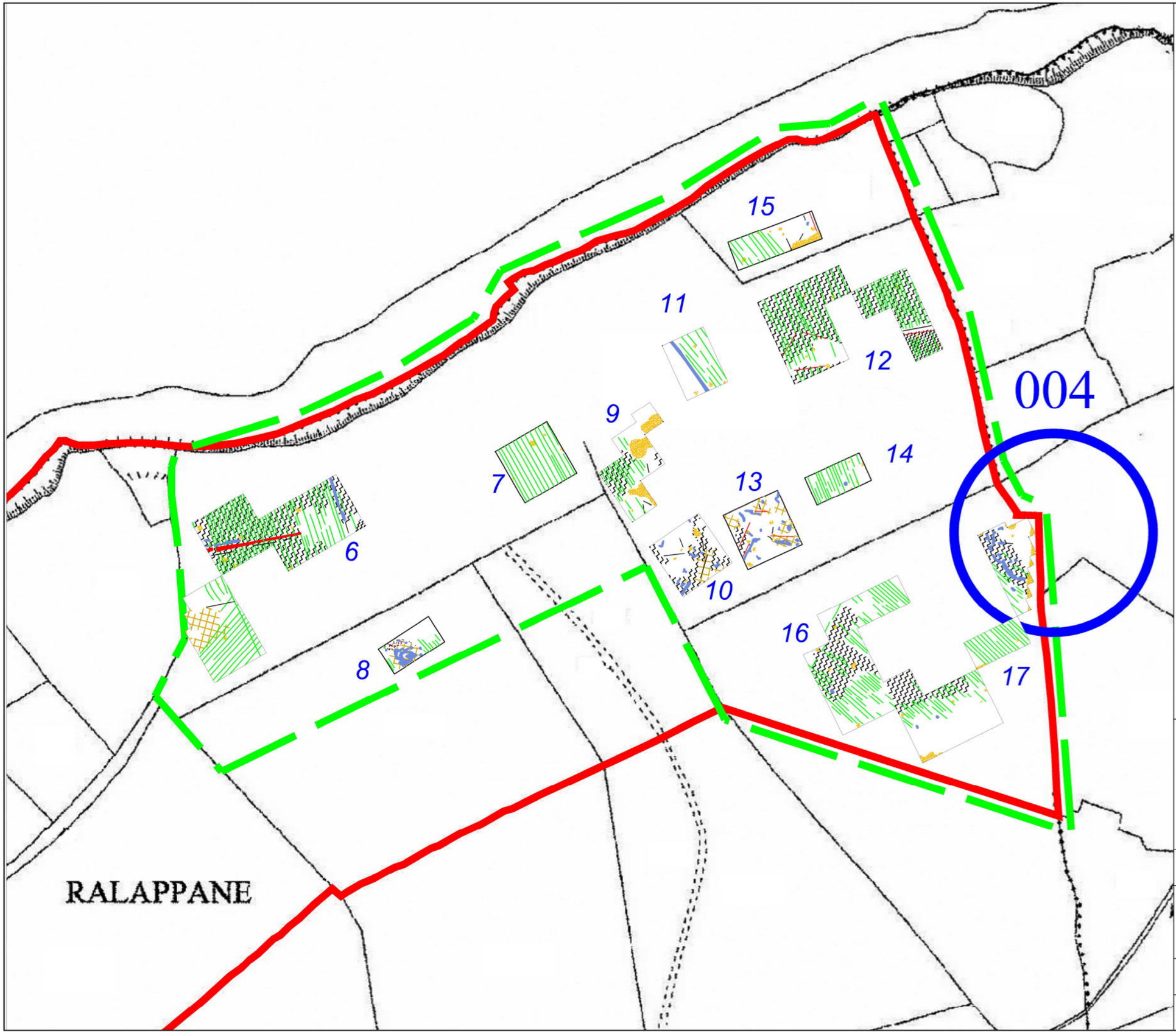


? Archaeology

Area Of Increased Magnetic Response

Area of Magnetic Disturbance

Trend

Negative Trend / Negative Anomaly

Cultivation

Natural

Ferrous

1 Detailed Survey

Gradiometer Scanning

Archaeological Study Area

004 RMP Site

N

0 METRES 100

BASED ON MAPPING PROVIDED BY THE CLIENT

TARGET Archaeological Geophysics

Geophysical Prospection For Archaeological Assessment

Apartment 25
Block 11
Gallery Quay
Dublin 2

Mobile +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

PROJECT: BALLYLONGFORD, CO. KERRY

TITLE: SUMMARY INTERPRETATION: DETAILED SURVEY AREAS 6 - 17

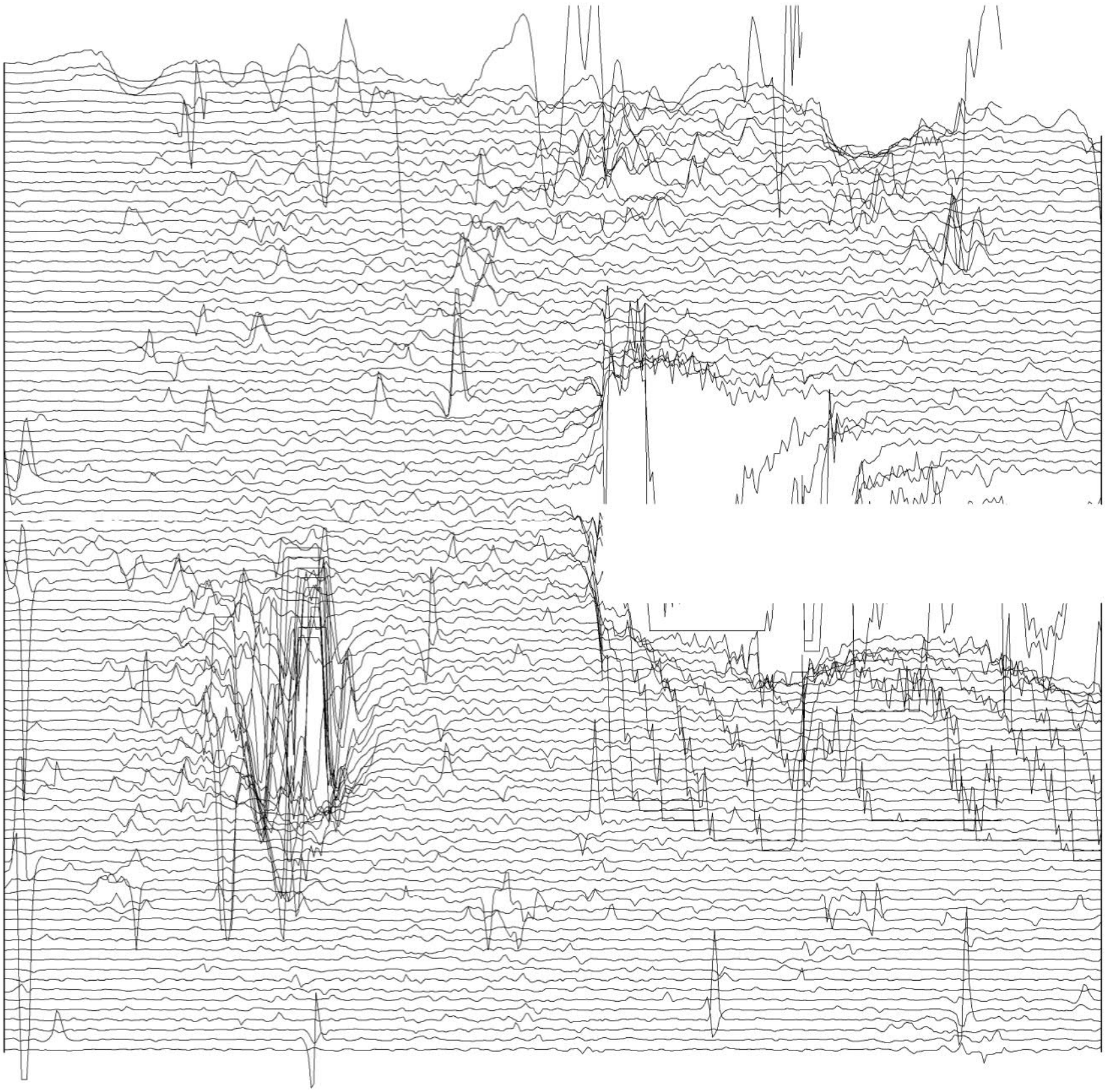
LICENCE: 06R0167

JOB NUMBER: 06/044

CLIENT: SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS

FIGURE:	DATE:	SCALE:
FIG. 7	20/10/06	1/2500 @ A3

AREA 1 ARCHIVE: XY TRACE
BALLYLONGFORD, CO. KERRY



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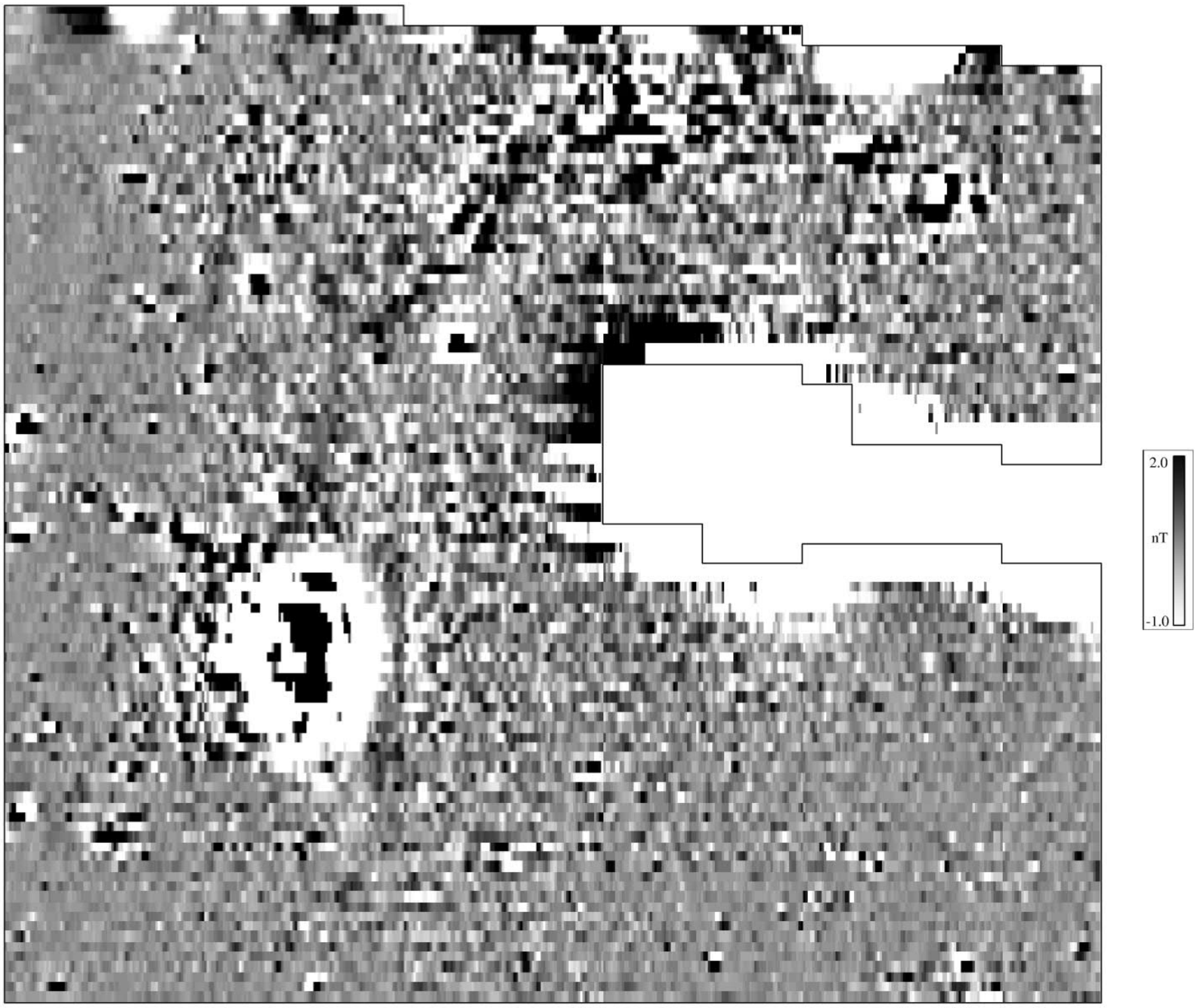
TARGET Archaeological Geophysics

Geophysical Prospection For Archaeological Assessment

Apartment 25
Block 11
Gallery Quay
Dublin 2

Mobile: +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

AREA 1 ARCHIVE: GREYSCALE
BALLYLONGFORD, CO. KERRY



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CLIENT:	FIGURE:	DATE:	SCALE:	JOB NUMBER:	LICENCE NO.	
SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIG. 9	20/10/06	1/500 @ A3	06/044	06R0167	

TARGET Archaeological Geophysics
Geophysical Prospection For Archaeological Assessment
Apartment 25
Block 11
Gallery Quay
Dublin 2
Mobile: +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
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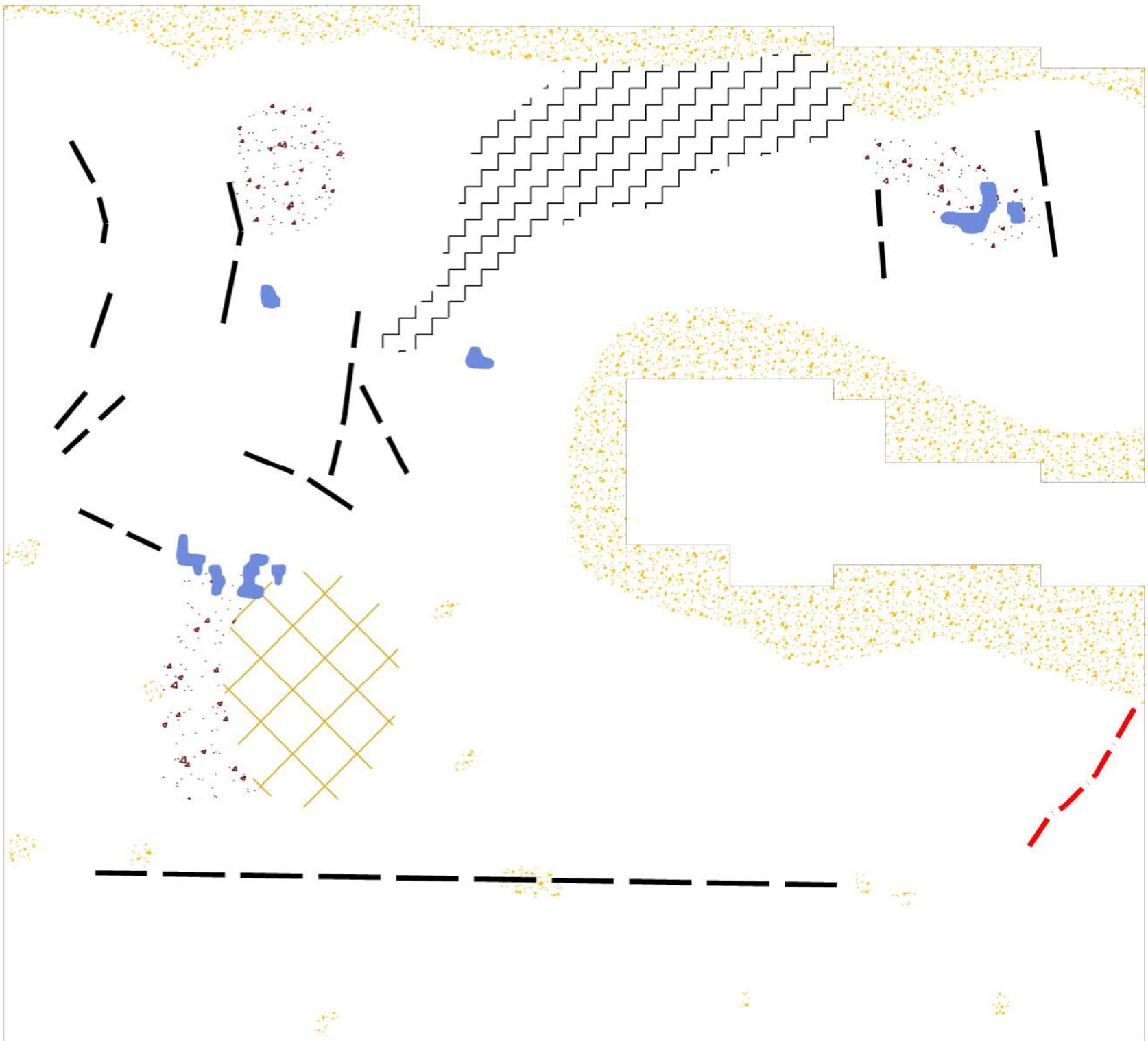
Email: survey@targetgeophysics.ie

AREA 1 ARCHIVE: INTERPRETATION
BALLYLONGFORD, CO. KERRY



? Archaeology
Area Of Increased Magnetic Response
Area of Magnetic Disturbance
Trend
Negative Trend
Natural
Ferrous

N

0 METRES 20

PROJECT: BALLYLONGFORD, CO. KERRY

TITLE: ARCHIVE, AREA 1: INTERPRETATION

CLIENT:	FIGURE:	DATE:	SCALE:	JOB NUMBER:	LICENCE NO.
SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIG. 10	20/10/06	1/500 @ A3	06/044	06R0167

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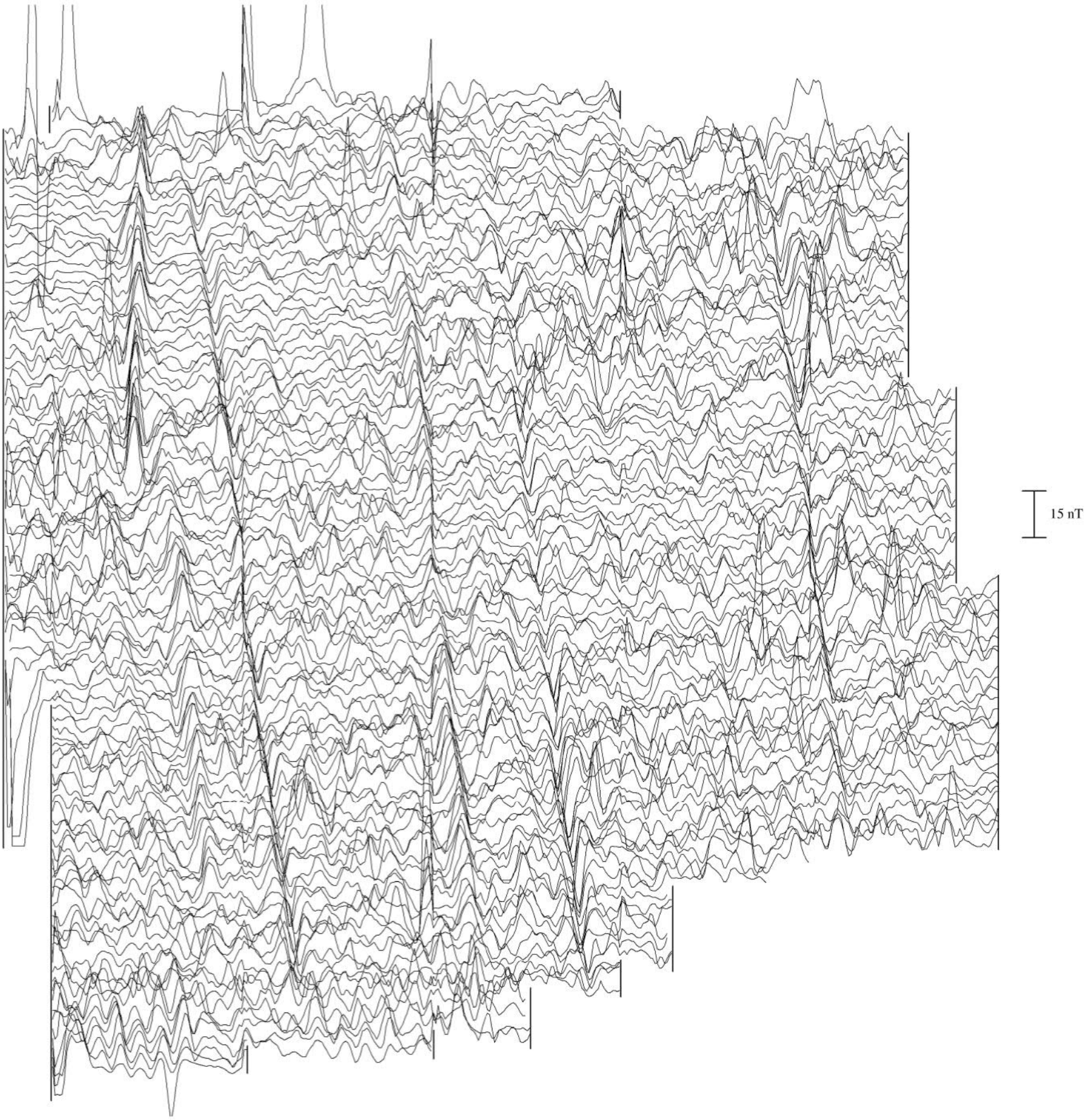
Geophysical Prospection For Archaeological Assessment

Apartment 25
Block 11
Gallery Quay
Dublin 2

Mobile: +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

AREA 2 ARCHIVE: XY TRACE
BALLYLONGFORD, CO. KERRY



0 METRES 20

PROJECT: BALLYLONGFORD, CO. KERRY			TITLE: ARCHIVE, AREA 1: XY TRACE			
CLIENT: SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIGURE: FIG. 11	DATE: 20/10/06	SCALE: 1/500 @ A3	JOB NUMBER: 06/044	LICENCE NO. 06R0167	

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Geophysical Prospection For Archaeological Assessment
Apartment 25
Block 11
Gallery Quay
Dublin 2
Mobile: +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
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AREA 2 ARCHIVE: GREYSCALE
BALLYLONGFORD, CO. KERRY

0 METRES 20

PROJECT:		TITLE:				
BALLYLONGFORD, CO. KERRY		ARCHIVE, AREA 2: GREYSCALE				
CLIENT:	FIGURE:	DATE:	SCALE:	JOB NUMBER:	LICENCE NO.	
SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIG. 12	20/10/06	1/500 @ A3	06/044	06R0167	

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Apartment 25
Block 11
Gallery Quay
Dublin 2
Mobile: +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
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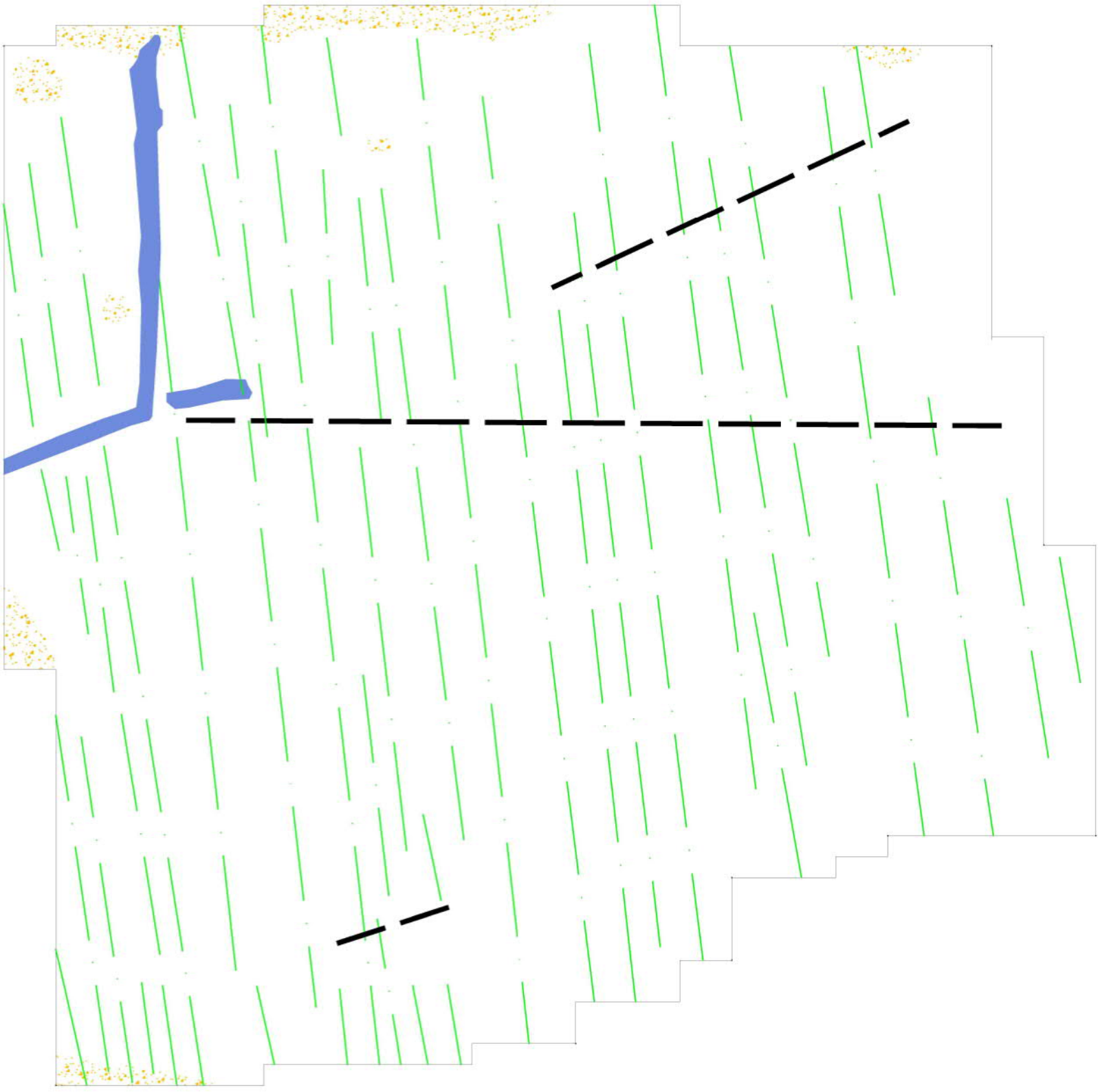
AREA 2 ARCHIVE: INTERPRETATION
BALLYLONGFORD, CO. KERRY



0 METRES 20

? Archaeology | Trend | Cultivation | Ferrous

PROJECT:	TITLE:				
BALLYLONGFORD, CO. KERRY	ARCHIVE, AREA 2: INTERPRETATION				
CLIENT:	FIGURE:	DATE:	SCALE:	JOB NUMBER:	LICENCE NO.
SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIG. 13	20/10/06	1/500 @ A3	06/044	06R0167

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Apartment 25
Block 11
Gallery Quay
Dublin 2
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Tel & Fax: +353 (0)1 671 5292
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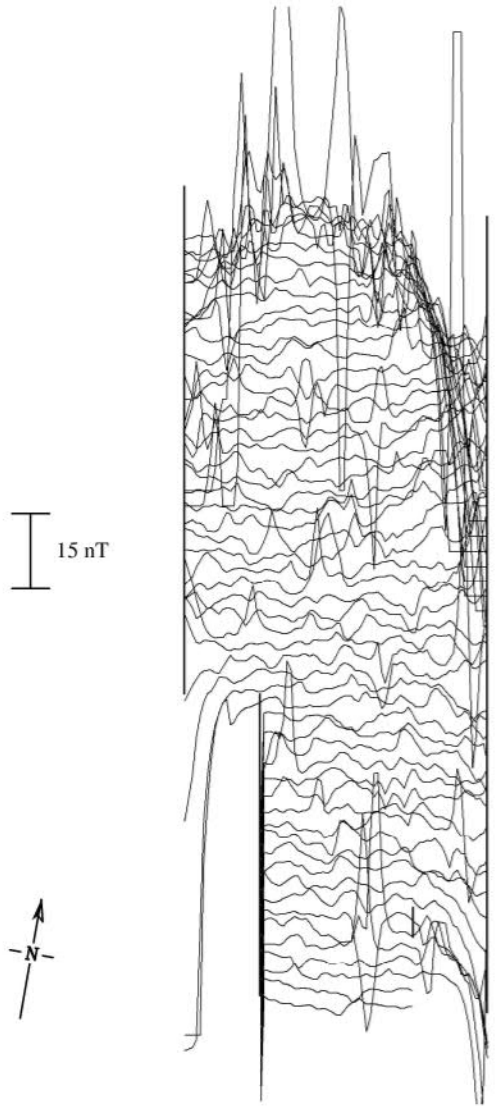
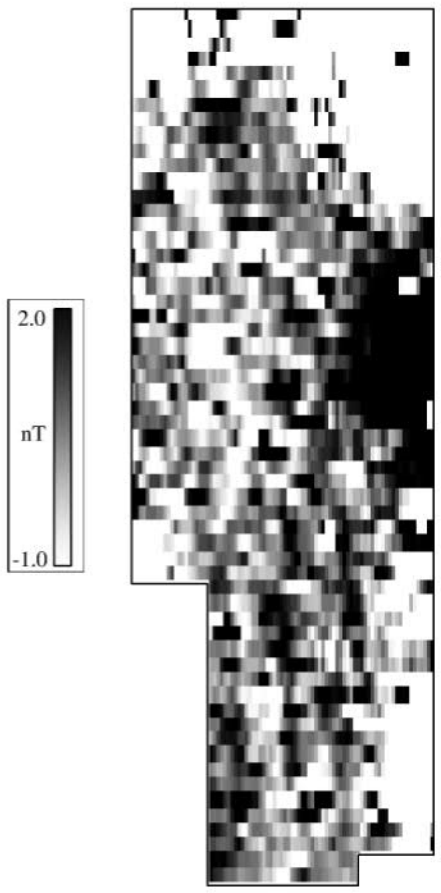
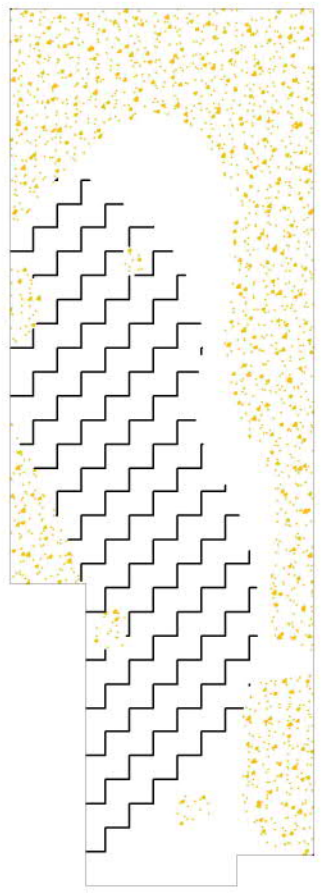
AREAS 3 & 4 ARCHIVE: XY TRACE, GREYSCALE & INTERPRETATION
BALLYLONGFORD, CO. KERRY

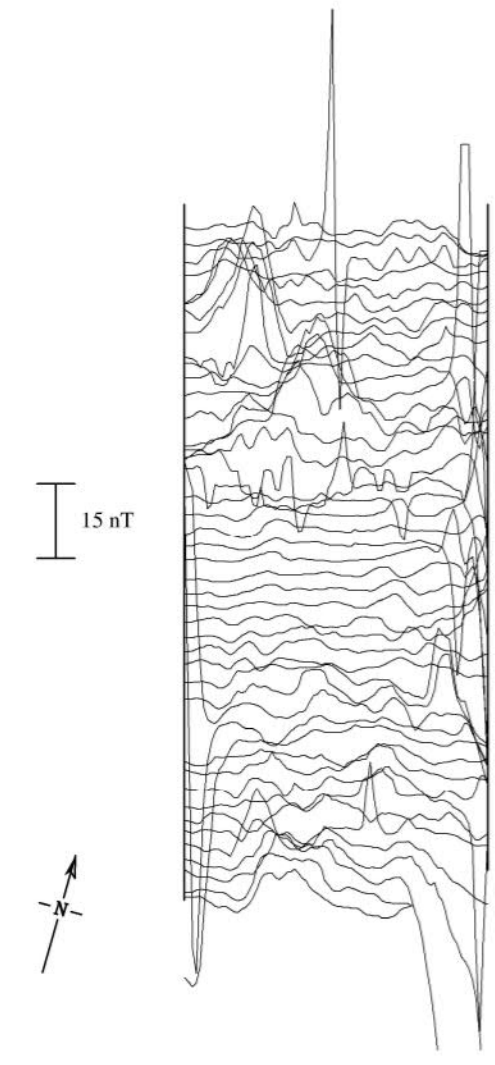
AREA 3

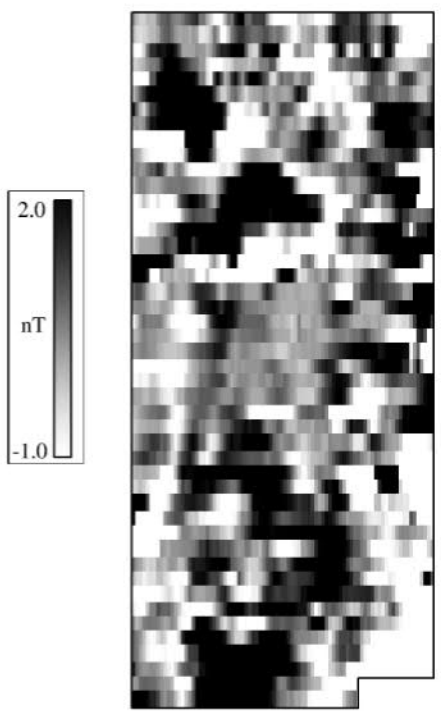


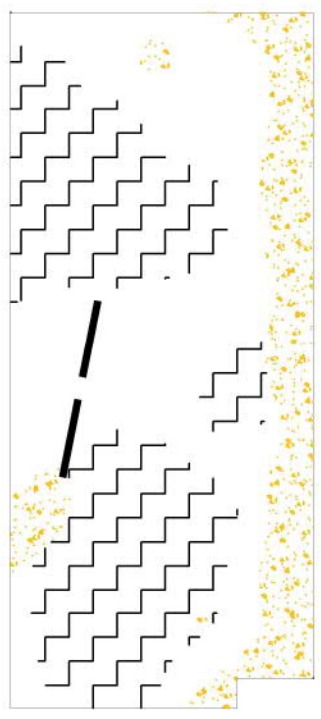




AREA 4







Trend Natural Ferrous

0 METRES 20

PROJECT:		TITLE:				
BALLYLONGFORD, CO. KERRY		ARCHIVE, AREAS 3 & 4: XY TRACE, GREYSCALE & INTERPRETATION				
CLIENT:	FIGURE:	DATE:	SCALE:	JOB NUMBER:	LICENCE NO.	
SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIG. 14	20/10/06	1/500 @ A3	06/044	06R0167	

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Apartment 25
Block 11
Gallery Quay
Dublin 2

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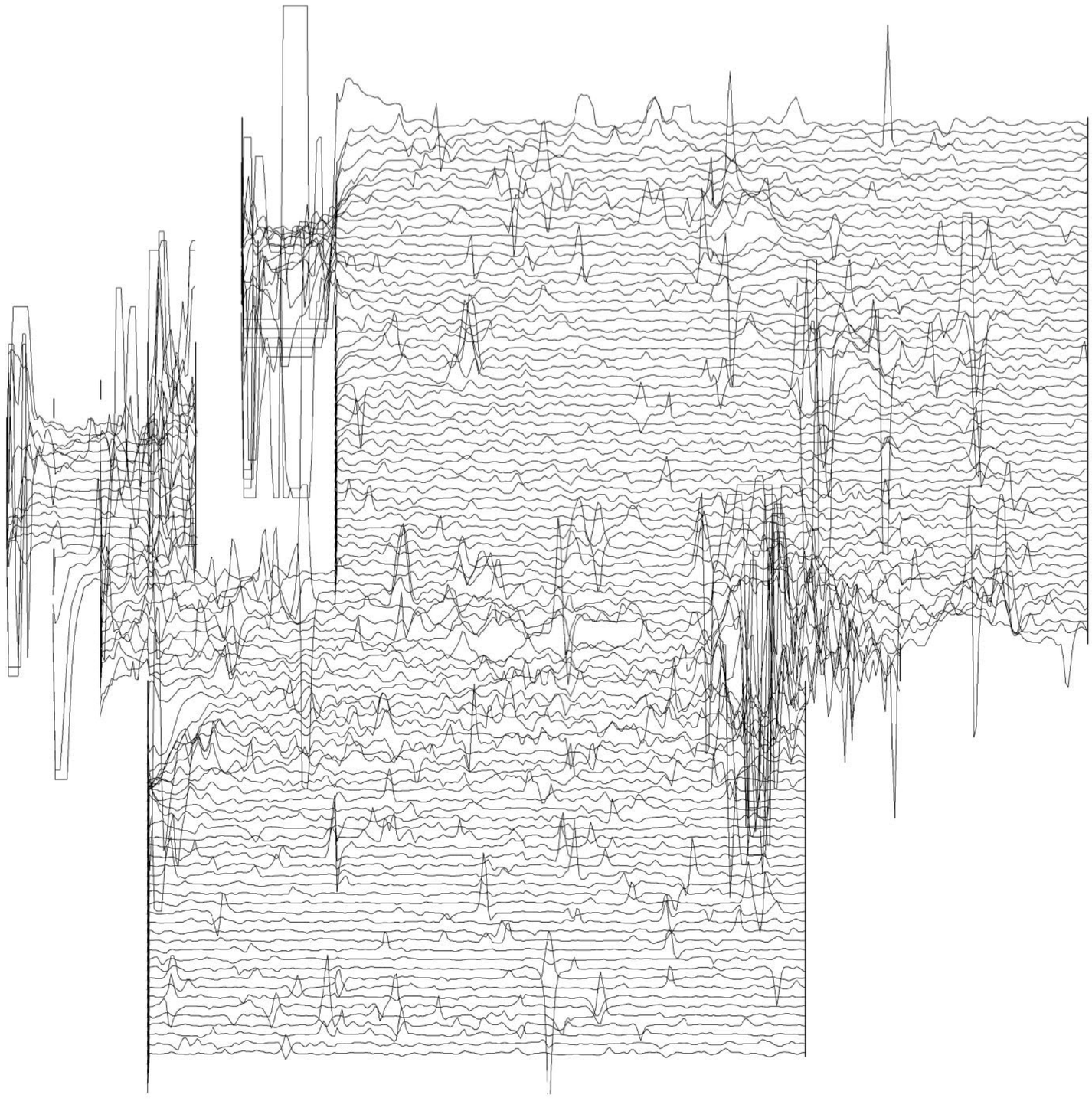
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

AREA 5 ARCHIVE: XY TRACE
BALLYLONGFORD, CO. KERRY



0 METRES 20

PROJECT:		TITLE:				
BALLYLONGFORD, CO. KERRY		ARCHIVE, AREA 5: XY TRACE				
CLIENT:	FIGURE:	DATE:	SCALE:	JOB NUMBER:	LICENCE NO.	
SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIG. 15	20/10/06	1/500 @ A3	06/044	06R0167	

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Geophysical Prospection For Archaeological Assessment

Apartment 25
Block 11
Gallery Quay
Dublin 2

Mobile: +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
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AREA 5 ARCHIVE: GREYSCALE
BALLYLONGFORD, CO. KERRY

0 METRES 20

PROJECT:		TITLE:			
BALLYLONGFORD, CO. KERRY		ARCHIVE, AREA 5: GREYSCALE			
CLIENT:	FIGURE:	DATE:	SCALE:	JOB NUMBER:	LICENCE NO.
SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIG. 16	20/10/06	1/500 @ A3	06/044	06R0167

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Apartment 25
Block 11
Gallery Quay
Dublin 2
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Tel & Fax: +353 (0)1 671 5292
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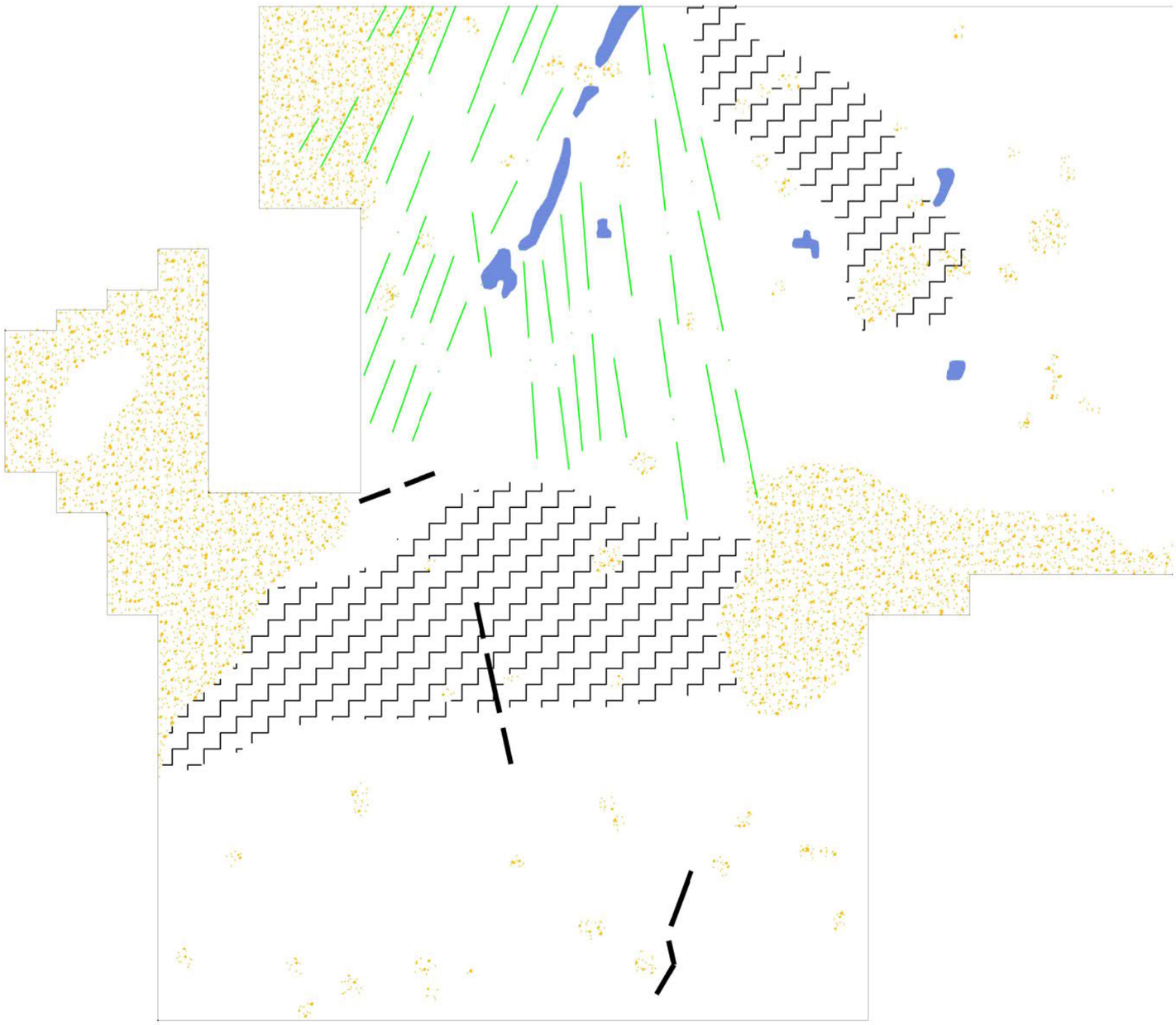
AREA 5 ARCHIVE: INTERPRETATION
BALLYLONGFORD, CO. KERRY



? Archaeology | Natural | Trend | Cultivation | Ferrous

0 METRES 20

PROJECT:		TITLE:				
BALLYLONGFORD, CO. KERRY		ARCHIVE, AREA 5: INTERPRETATION				
CLIENT:	FIGURE:	DATE:	SCALE:	JOB NUMBER:	LICENCE NO.	
SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIG. 17	20/10/06	1/500 @ A3	06/044	06R0167	

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Apartment 25
Block 11
Gallery Quay
Dublin 2
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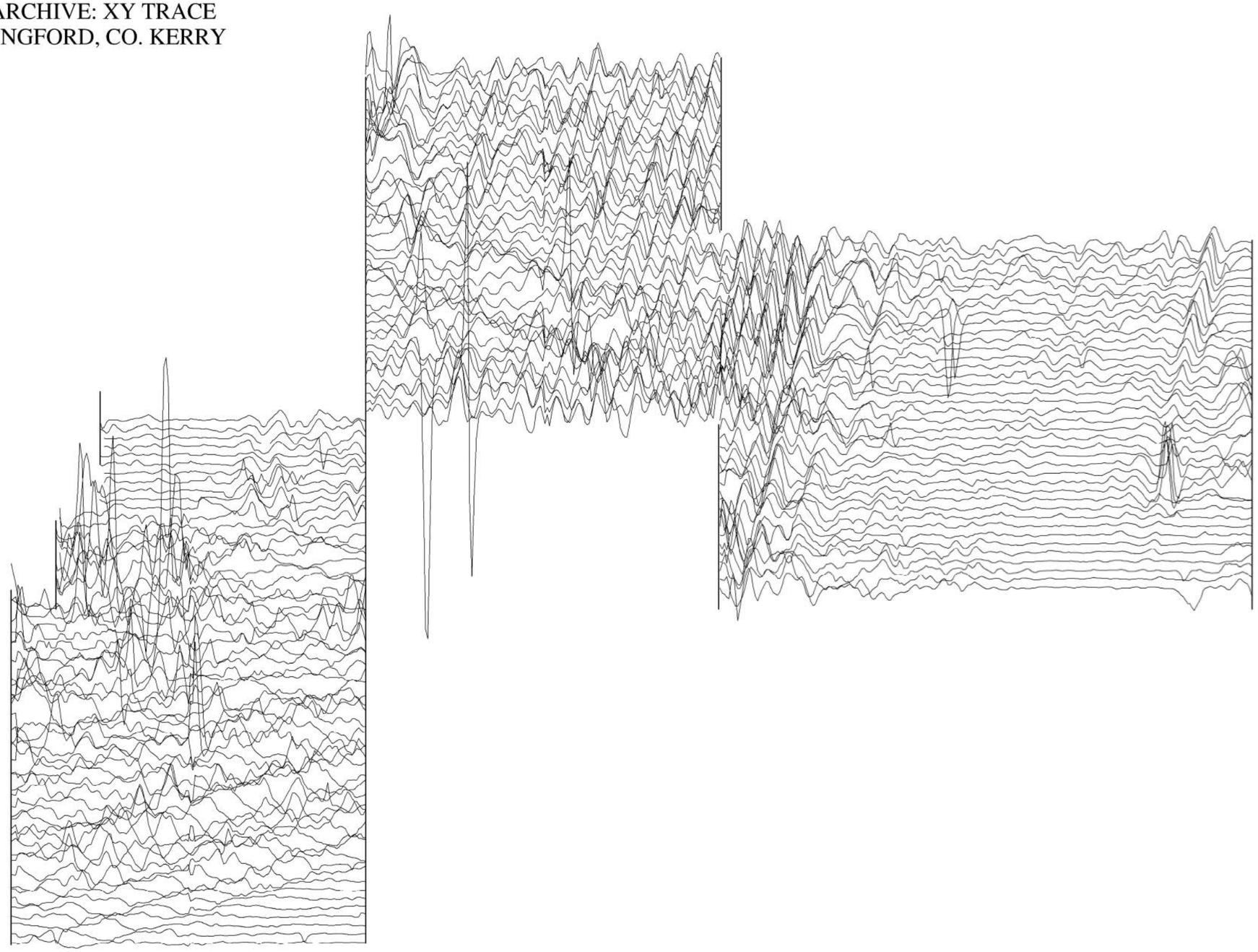
AREA 6 ARCHIVE: XY TRACE
BALLYLONGFORD, CO. KERRY



0 METRES 20

PROJECT: BALLYLONGFORD, CO. KERRY	TITLE: ARCHIVE, AREA 6: XY TRACE					
CLIENT: SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIGURE: FIG. 18	DATE: 20/10/06	SCALE: 1/500 @ A3	JOB NUMBER: 06/044	LICENCE NO. 06R0167	

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Geophysical Prospection For Archaeological Assessment
Apartment 25
Block 11
Gallery Quay
Dublin 2
Mobile: +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
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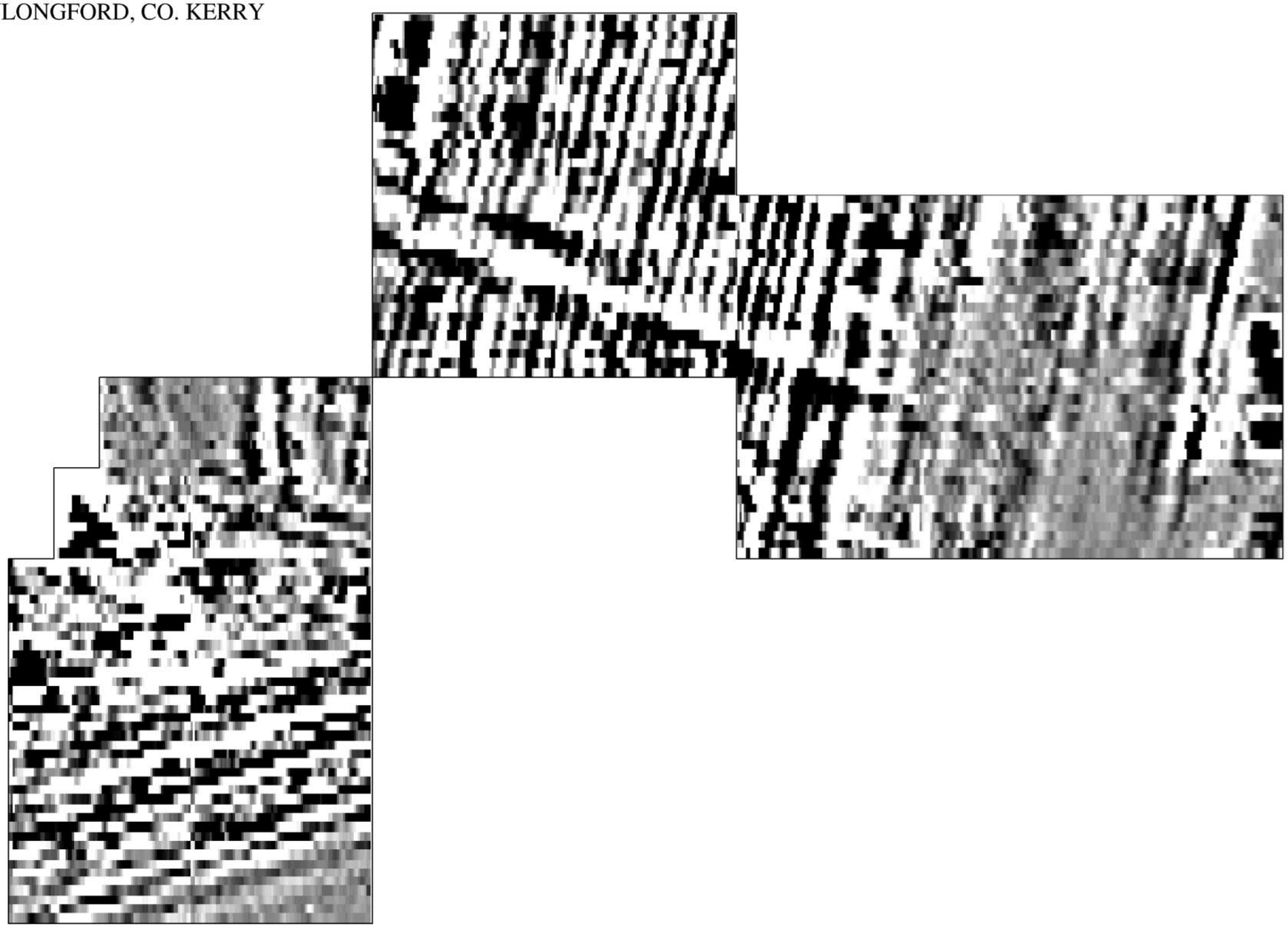
Email: survey@targetgeophysics.ie

AREA 6 ARCHIVE: GREYSCALE
BALLYLONGFORD, CO. KERRY



0 METRES 20

PROJECT: BALLYLONGFORD, CO. KERRY	TITLE: ARCHIVE, AREA 6: GREYSCALE					
CLIENT: SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIGURE: FIG. 19	DATE: 20/10/06	SCALE: 1/500 @ A3	JOB NUMBER: 06/044	LICENCE NO. 06R0167	

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Block 11
Gallery Quay
Dublin 2
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Tel & Fax: +353 (0)1 671 5292
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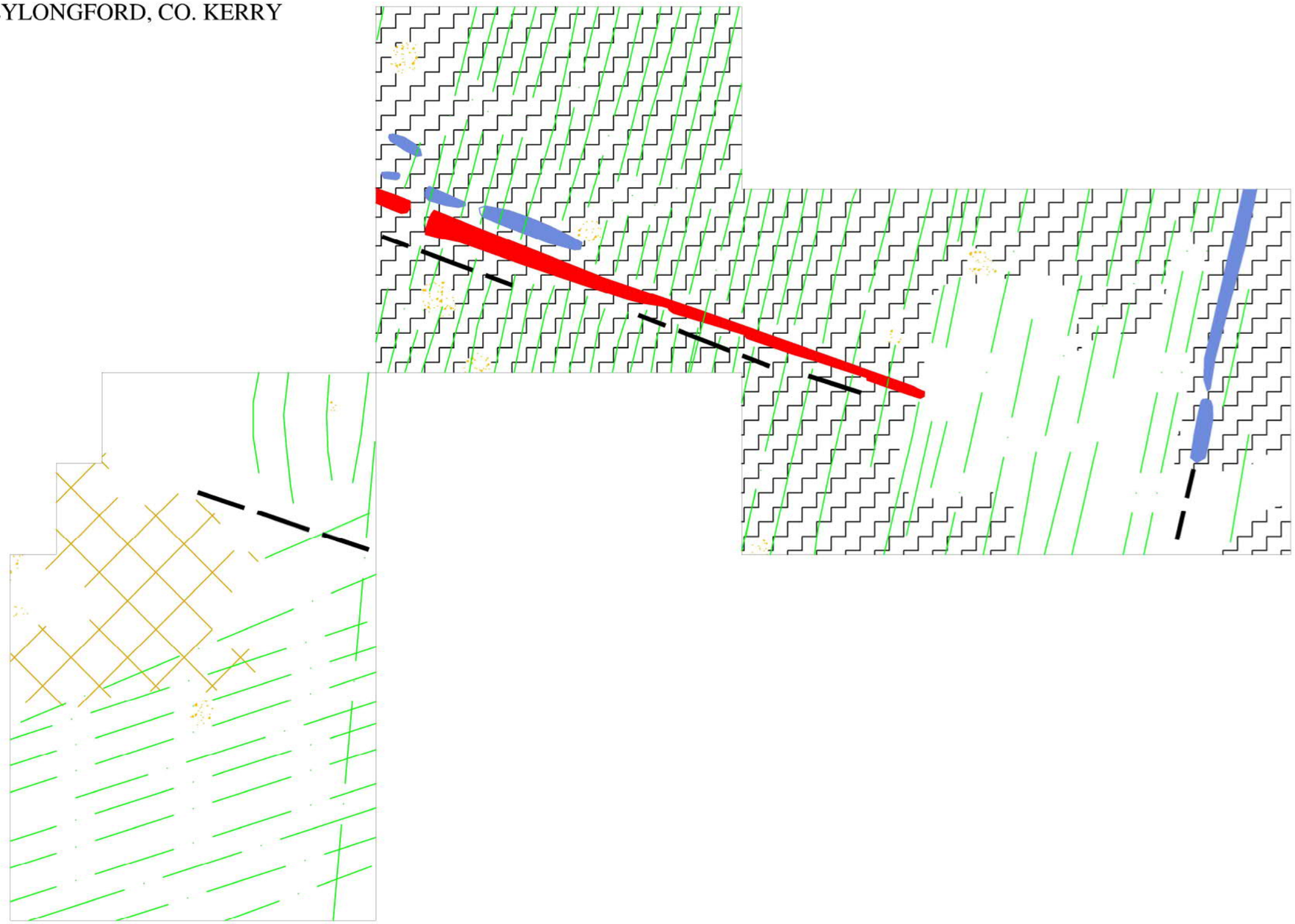
AREA 6 ARCHIVE: INTERPRETATION
BALLYLONGFORD, CO. KERRY



0 METRES 20

? Archaeology

Area of Magnetic Disturbance

Trend

Negative Anomaly

Cultivation

Natural

Ferrous

PROJECT: BALLYLONGFORD, CO. KERRY		TITLE: ARCHIVE, AREA 6: INTERPRETATION				
CLIENT: SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS		FIGURE: FIG. 20	DATE: 20/10/06	SCALE: 1/500 @ A3	JOB NUMBER: 06/044	LICENCE NO. 06R0167

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Geophysical Prospection For Archaeological Assessment
Apartment 25
Block 11
Gallery Quay
Dublin 2
Mobile: +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
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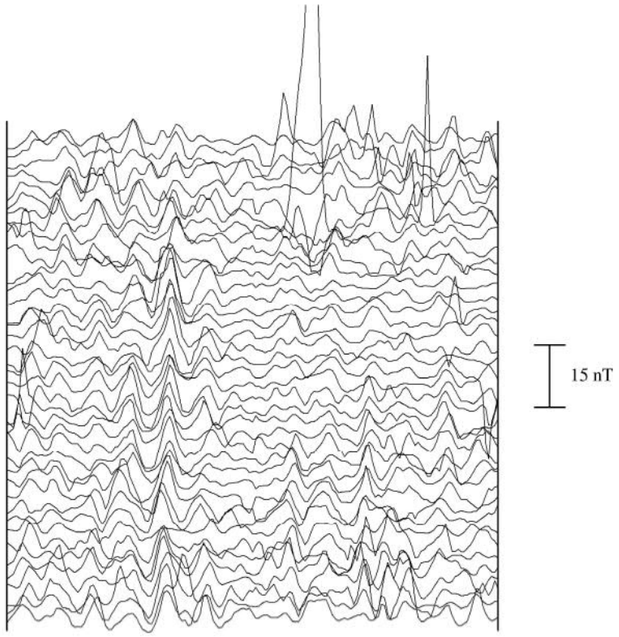
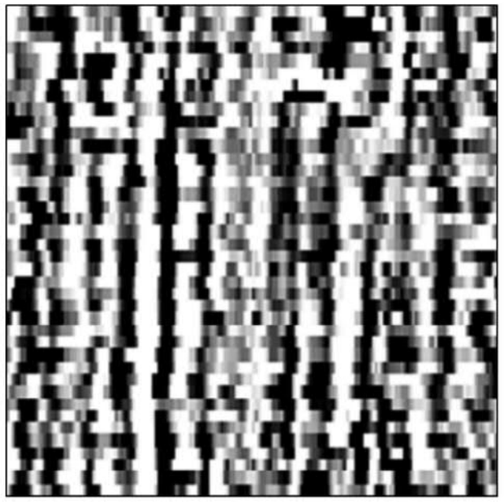
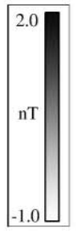
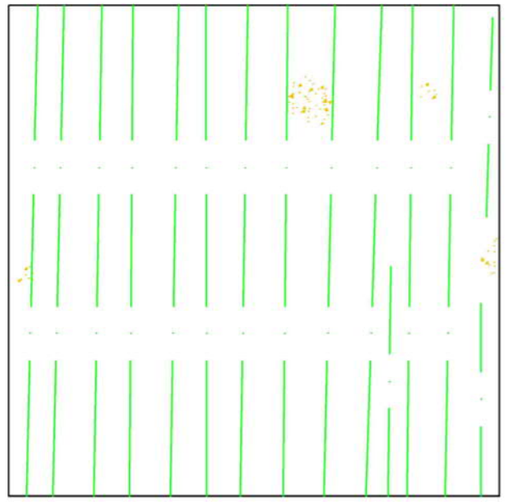
AREAS 7 & 8 ARCHIVE: XY TRACE, GREYSCALE & INTERPRETATION
BALLYLONGFORD, CO. KERRY

AREA 7

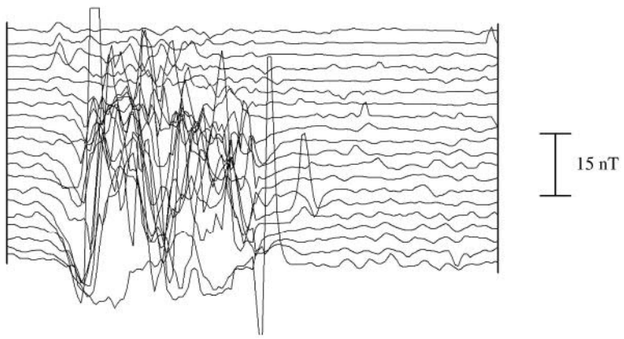


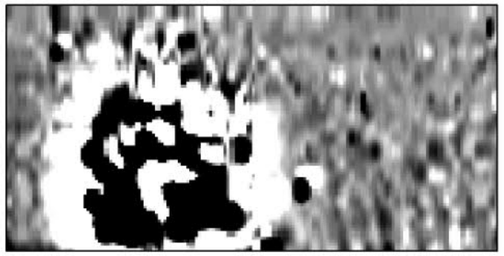


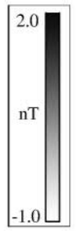


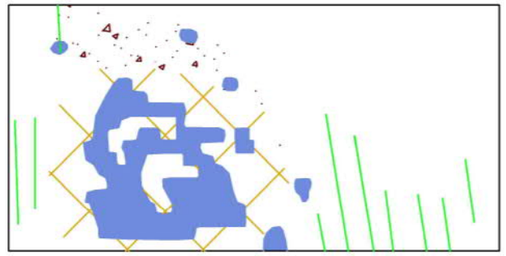


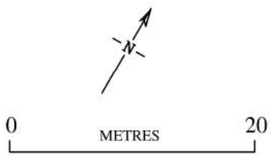
AREA 8











? Archaeology

Area Of Increased Magnetic Response

Area of Magnetic Disturbance

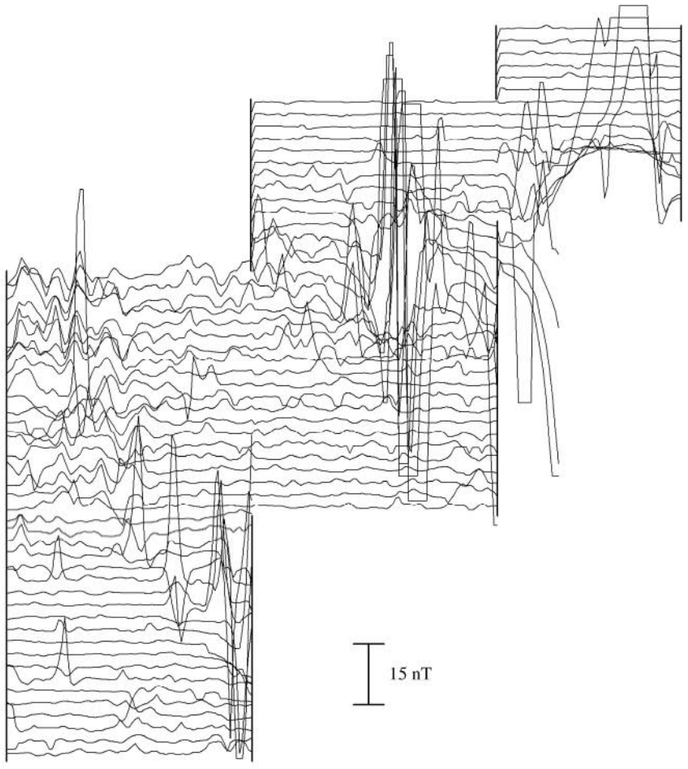
Trend

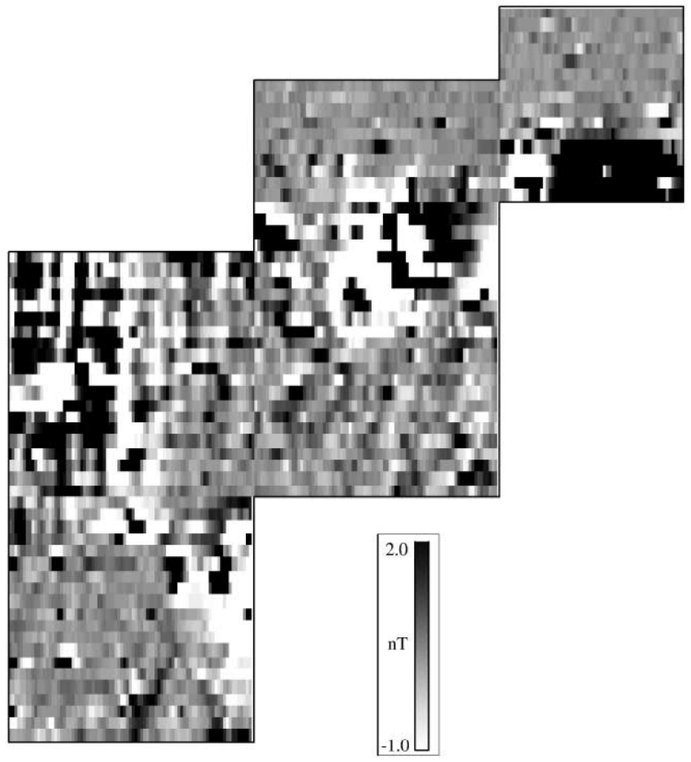
Cultivation

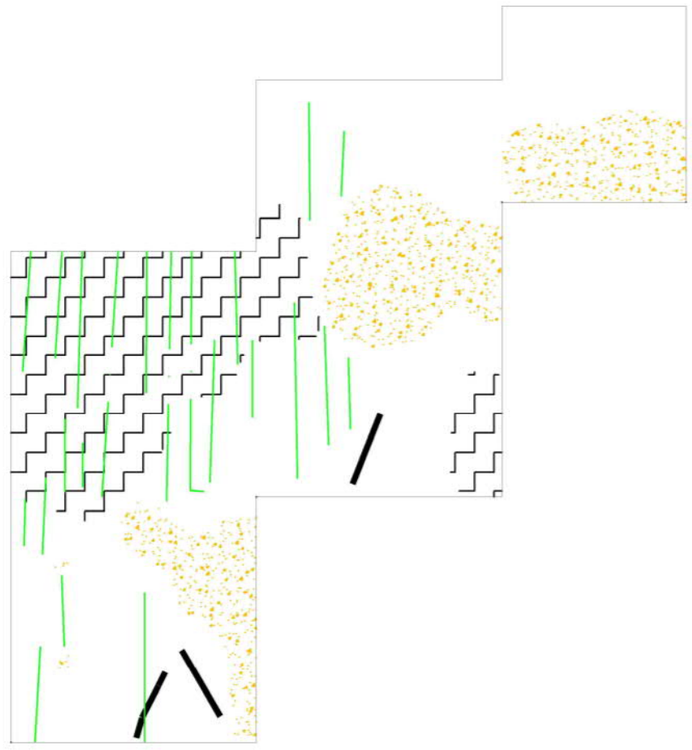
PROJECT: BALLYLONGFORD, CO. KERRY	TITLE: ARCHIVE, AREAS 7 & 8: XY TRACE, GREYSCALE & INTERPRETATION				
CLIENT: SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIGURE: FIG. 21	DATE: 20/10/06	SCALE: 1/500 @ A3	JOB NUMBER: 06/044	LICENCE NO. 06R0167

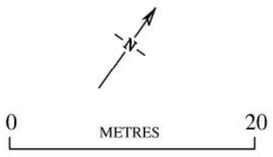
TARGET Archaeological Geophysics
Geophysical Prospection For Archaeological Assessment
Apartment 25
Block 11
Gallery Quay
Dublin 2
Mobile: +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

AREA 9 ARCHIVE: XY TRACE, GREYSCALE & INTERPRETATION
BALLYLONGFORD, CO. KERRY









Natural Trend Cultivation Ferrous

PROJECT:	TITLE:				
BALLYLONGFORD, CO. KERRY	ARCHIVE, AREA 9: XY TRACE, GREYSCALE & INTERPRETATION				
CLIENT:	FIGURE:	DATE:	SCALE:	JOB NUMBER:	LICENCE NO.
SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIG. 22	20/10/06	1/500 @ A3	06/044	06R0167

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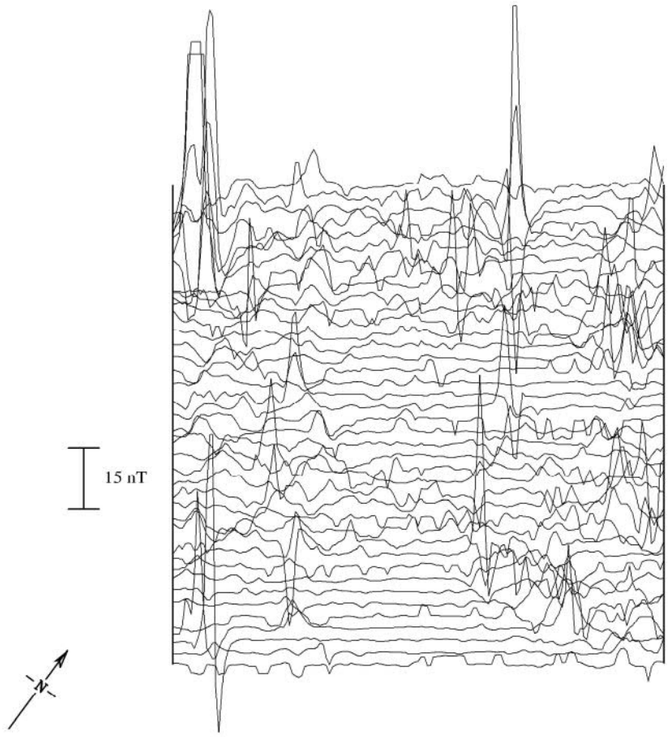
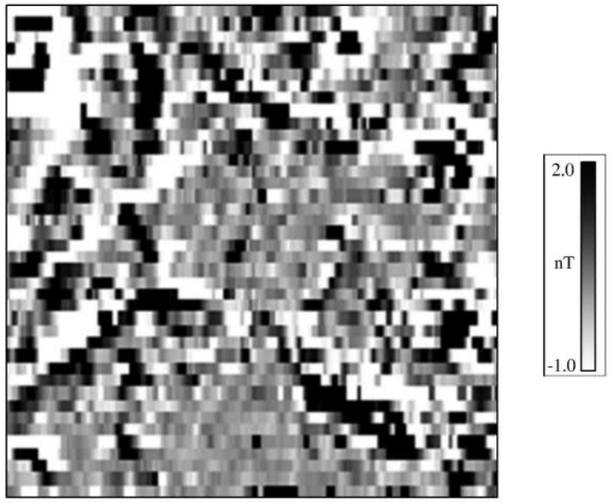
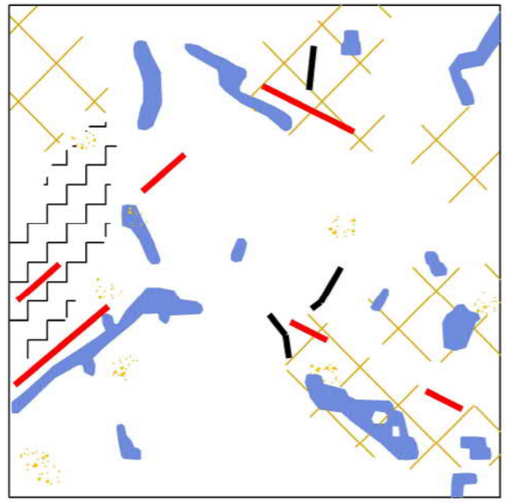
Geophysical Prospection For Archaeological Assessment
Apartment 25
Block 11
Gallery Quay
Dublin 2
Mobile: +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

AREAS 10 & 11 ARCHIVE: XY TRACE, GREYSCALE & INTERPRETATION
BALLYLONGFORD, CO. KERRY

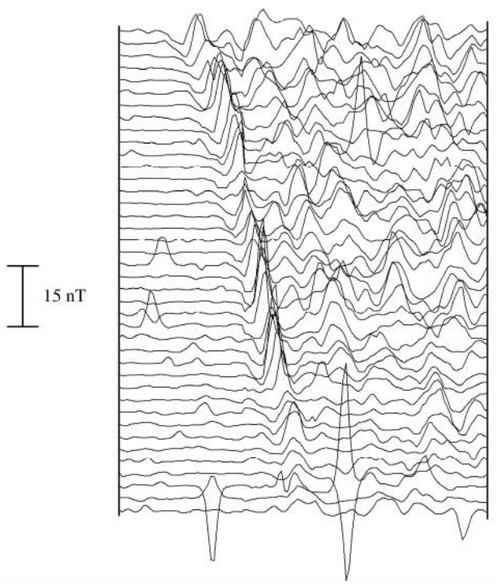
AREA 10

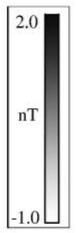


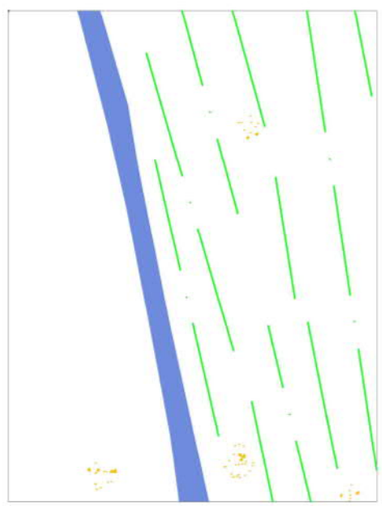




AREA 11







? Archaeology | Area of Magnetic Disturbance | Trend | Cultivation | Negative Trend | Natural | Ferrous

0 METRES 20

PROJECT: BALLYLONGFORD, CO. KERRY	TITLE: ARCHIVE, AREAS 10 & 11: XY TRACE, GREYSCALE & INTERPRETATION				
CLIENT: SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIGURE: FIG. 23	DATE: 20/10/06	SCALE: 1/500 @ A3	JOB NUMBER: 06/044	LICENCE NO. 06R0167

TARGET Archaeological Geophysics
Geophysical Prospection For Archaeological Assessment
Apartment 25
Block 11
Gallery Quay
Dublin 2
Mobile: +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
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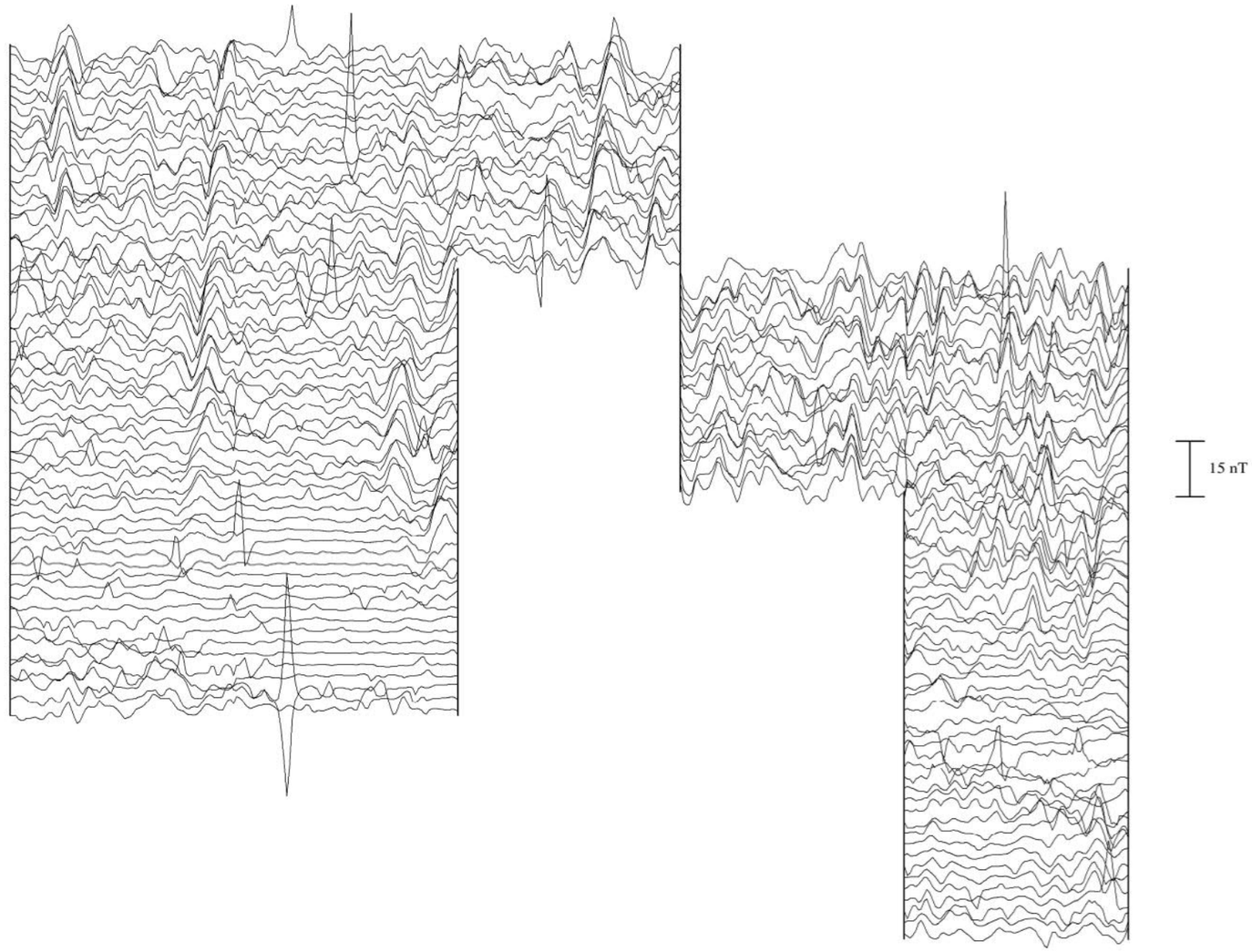
AREA 12 ARCHIVE: XY TRACE
BALLYLONGFORD, CO. KERRY



0 METRES 20

PROJECT: BALLYLONGFORD, CO. KERRY	TITLE: ARCHIVE, AREA 12: XY TRACE					
CLIENT: SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIGURE: FIG. 24	DATE: 20/10/06	SCALE: 1/500 @ A3	JOB NUMBER: 06/044	LICENCE NO. 06R0167	

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Geophysical Prospection For Archaeological Assessment
Apartment 25
Block 11
Gallery Quay
Dublin 2
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Tel & Fax: +353 (0)1 671 5292
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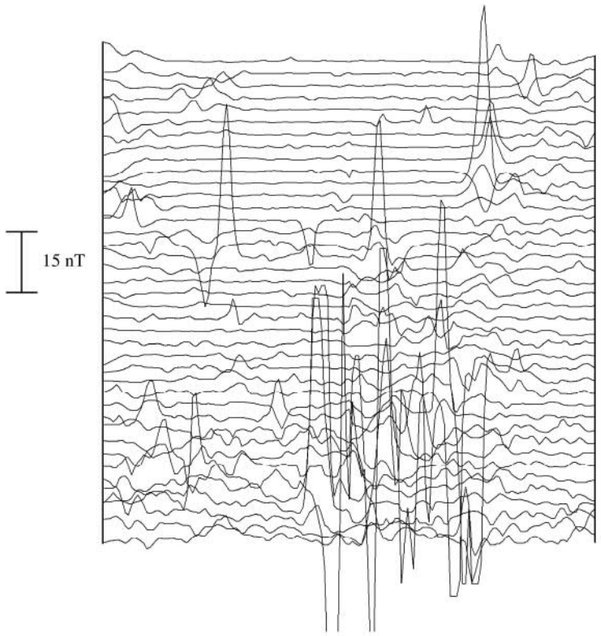
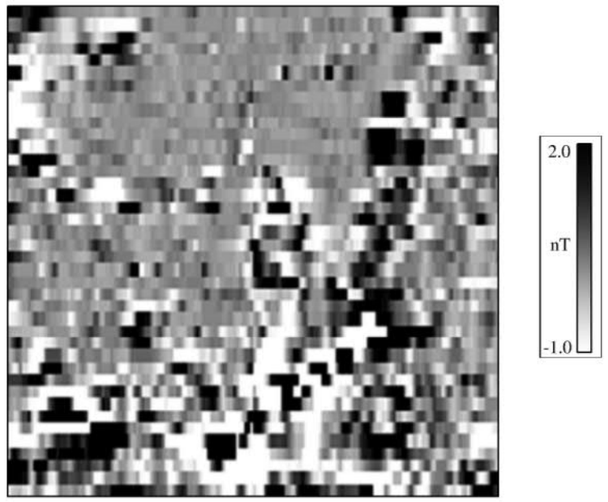
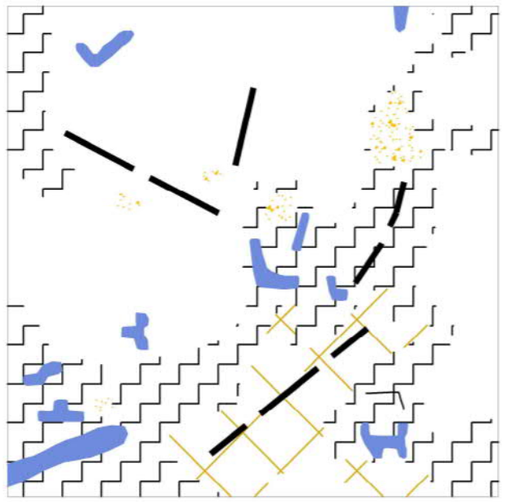
AREAS 13 & 14 ARCHIVE: XY TRACE, GREYSCALE & INTERPRETATION
BALLYLONGFORD, CO. KERRY

AREA 13







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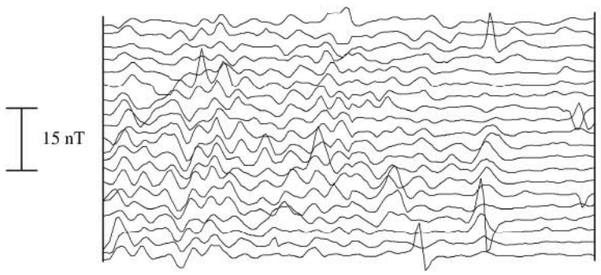
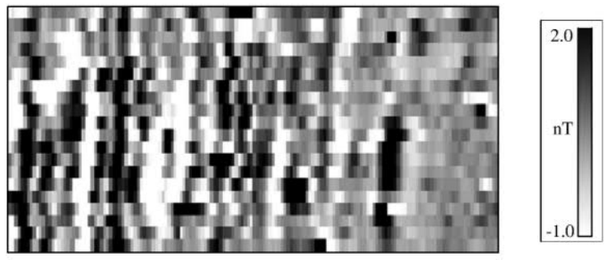
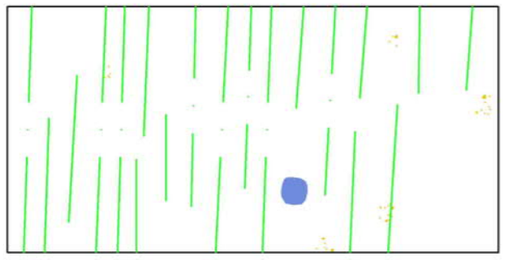






? Archaeology

Area of Magnetic Disturbance

Trend

Cultivation

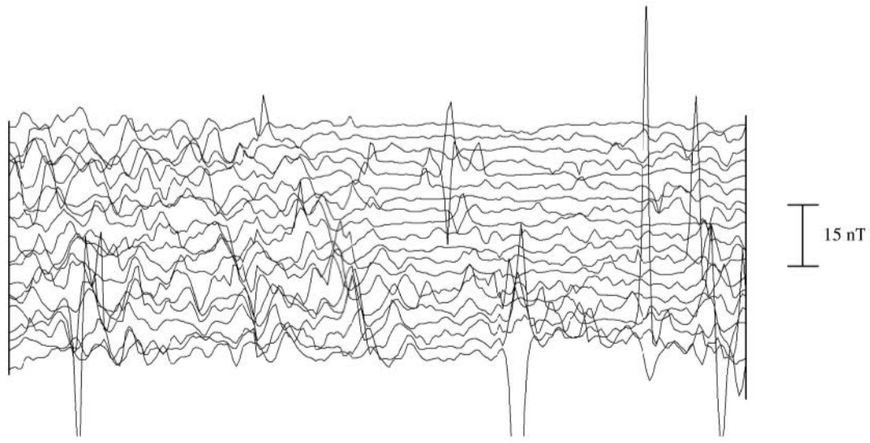
Natural

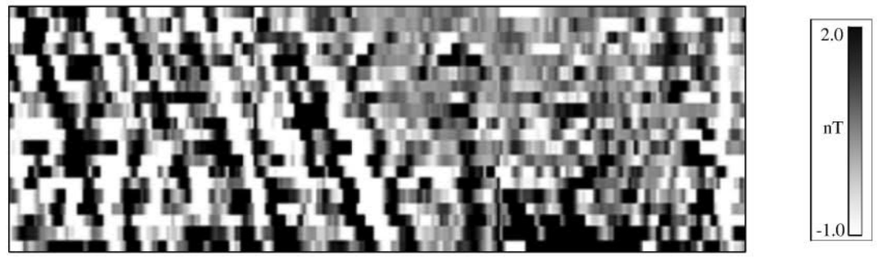
Ferrous

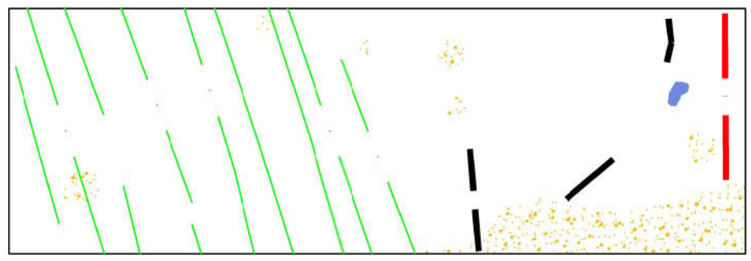
PROJECT: BALLYLONGFORD, CO. KERRY	TITLE: ARCHIVE, AREAS 13 & 14: XY TRACE, GREYSCALE & INTERPRETATION					
CLIENT: SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIGURE: FIG. 27	DATE: 20/10/06	SCALE: 1/500 @ A3	JOB NUMBER: 06/044	LICENCE NO. 06R0167	

TARGET Archaeological Geophysics
Geophysical Prospection For Archaeological Assessment
Apartment 25
Block 11
Gallery Quay
Dublin 2
Mobile: +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

AREA 15 ARCHIVE: XY TRACE, GREYSCALE & INTERPRETATION
BALLYLONGFORD, CO. KERRY







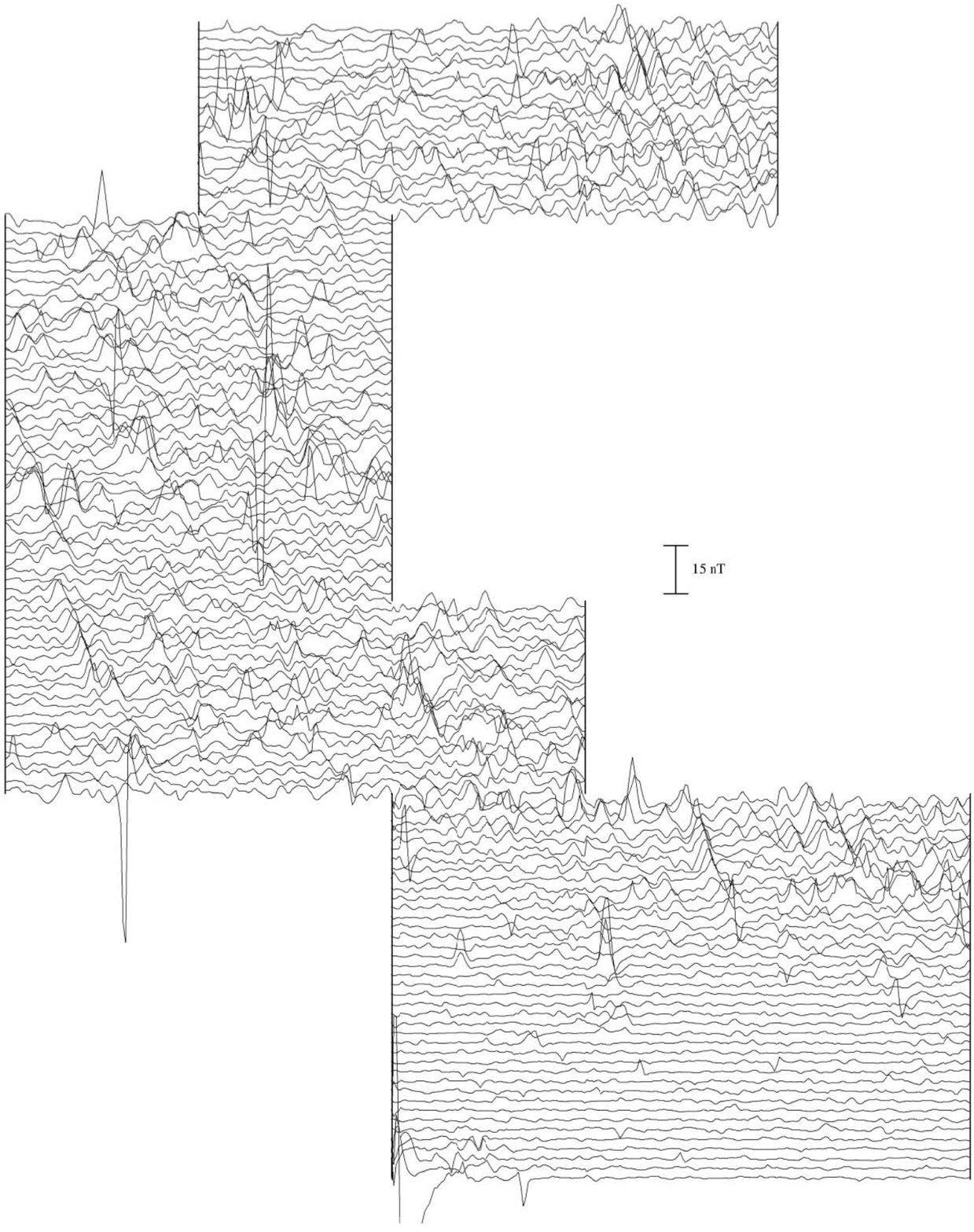
? Archaeology | Trend | Negative Trend | Cultivation | Ferrous

0 METRES 20

PROJECT: BALLYLONGFORD, CO. KERRY		TITLE: ARCHIVE, AREA 15: INTERPRETATION			
CLIENT: SHEILA LANe & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIGURE: FIG. 28	DATE: 20/10/06	SCALE: 1/500 @ A3	JOB NUMBER: 06/044	LICENCE NO. 06R0167

TARGET Archaeological Geophysics
Geophysical Prospection For Archaeological Assessment
Apartment 25
Block 11
Gallery Quay
Dublin 2
Mobile: +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

AREA 16 ARCHIVE: XY TRACE
BALLYLONGFORD, CO. KERRY

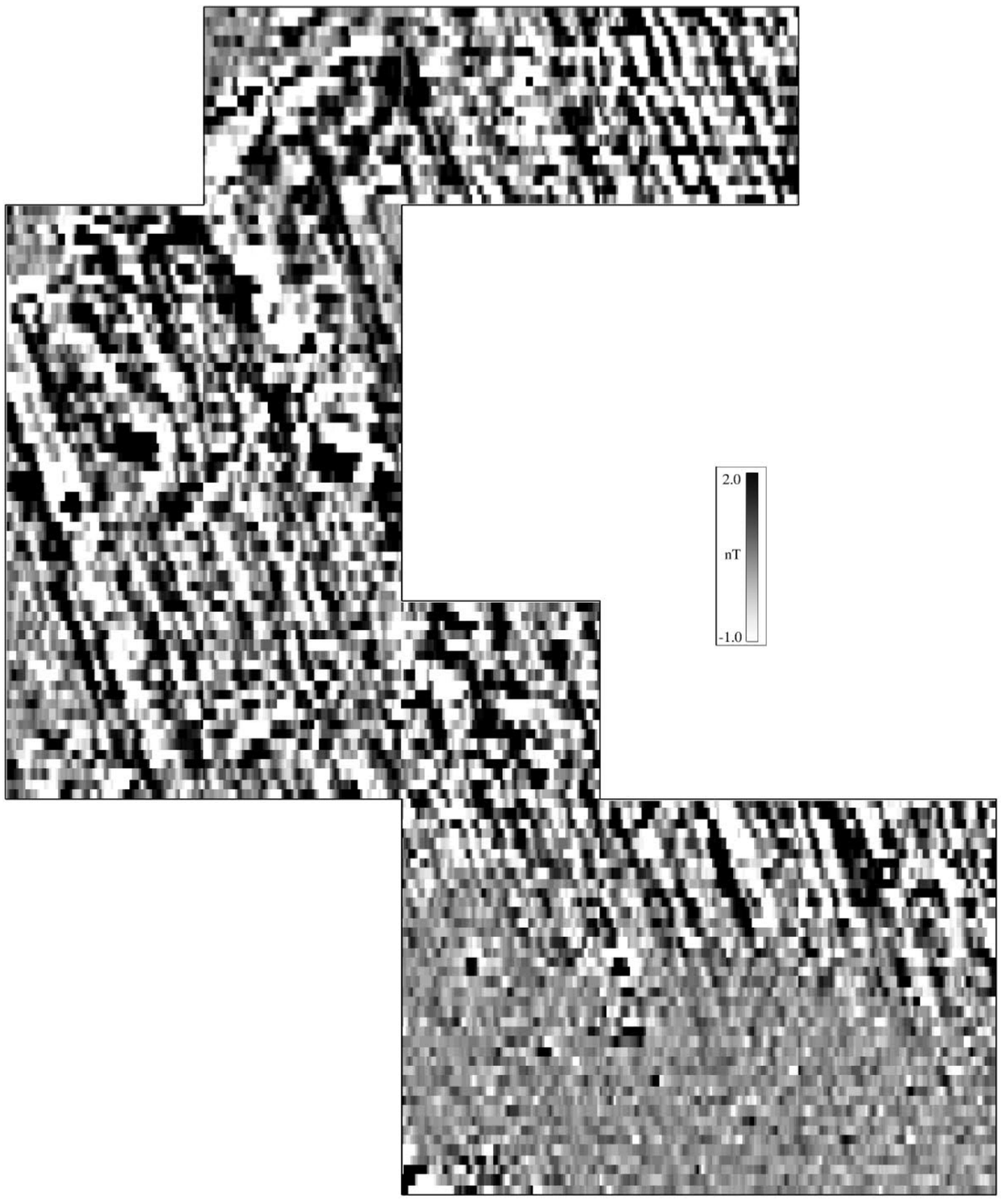


0 METRES 20

PROJECT: BALLYLONGFORD, CO. KERRY		TITLE: ARCHIVE, AREA 16: XY TRACE			
CLIENT: SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIGURE: FIG. 29	DATE: 20/10/06	SCALE: 1/500 @ A3	JOB NUMBER: 06/044	LICENCE NO. 06R0167

TARGET Archaeological Geophysics
Geophysical Prospection For Archaeological Assessment
Apartment 25
Block 11
Gallery Quay
Dublin 2
Mobile: +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

AREA 16 ARCHIVE: GREYSCALE
BALLYLONGFORD, CO. KERRY

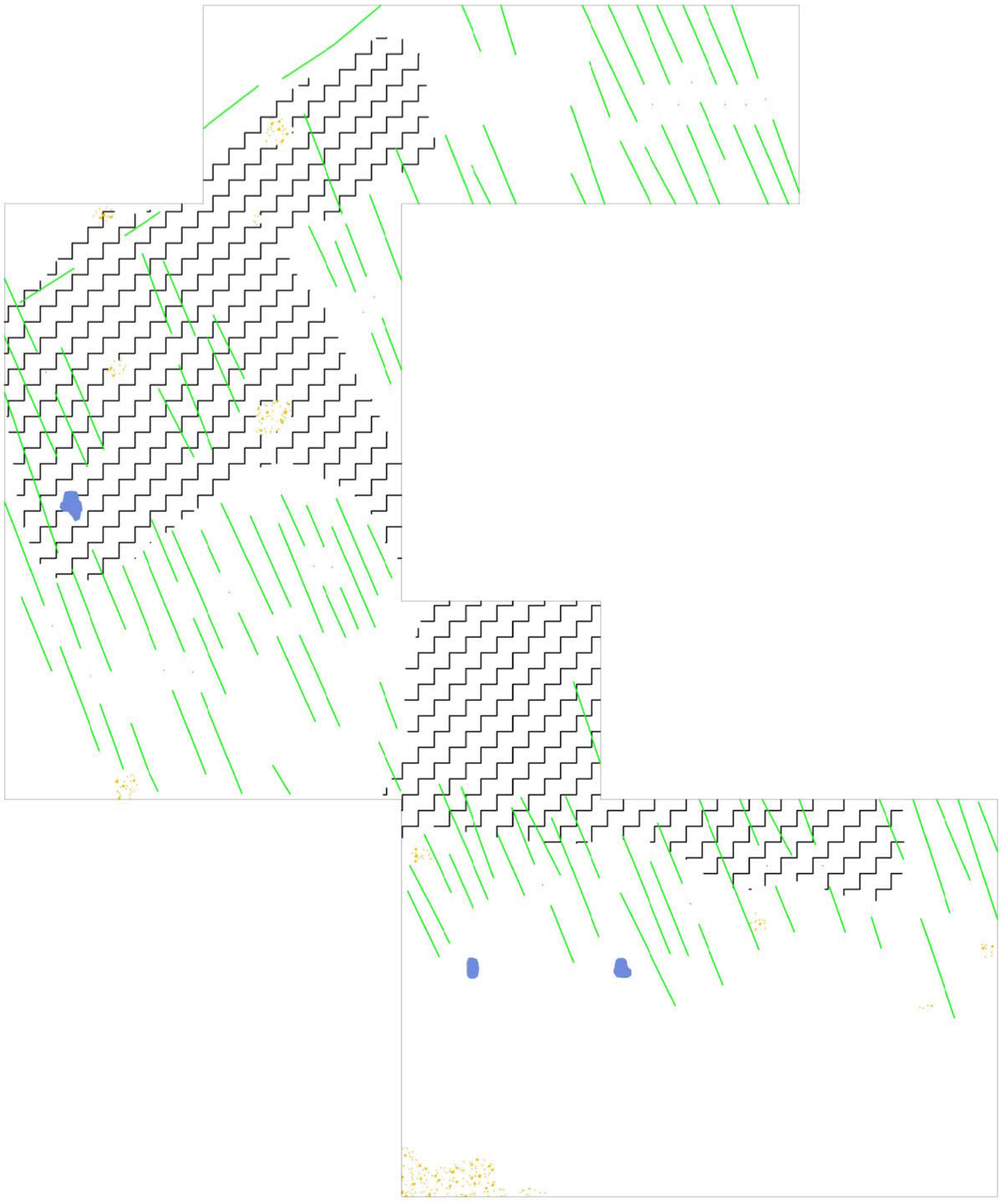


0 METRES 20

PROJECT:		TITLE:				
BALLYLONGFORD, CO. KERRY		ARCHIVE, AREA 16: GREYSCALE				
CLIENT: SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIGURE: FIG. 30	DATE: 20/10/06	SCALE: 1/500 @ A3	JOB NUMBER: 06/044	LICENCE NO. 06R0167	

TARGET Archaeological Geophysics
Geophysical Prospection For Archaeological Assessment
Apartment 25
Block 11
Gallery Quay
Dublin 2
Mobile: +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

AREA 16 ARCHIVE: INTERPRETATION
BALLYLONGFORD, CO. KERRY



? Archaeology | Cultivation | Natural | Ferrous

0 METRES 20

PROJECT:	TITLE:				
BALLYLONGFORD, CO. KERRY	ARCHIVE, AREA 16: INTERPRETATION				
CLIENT: SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIGURE: FIG. 31	DATE: 20/10/06	SCALE: 1/500 @ A3	JOB NUMBER: 06/044	LICENCE NO. 06R0167

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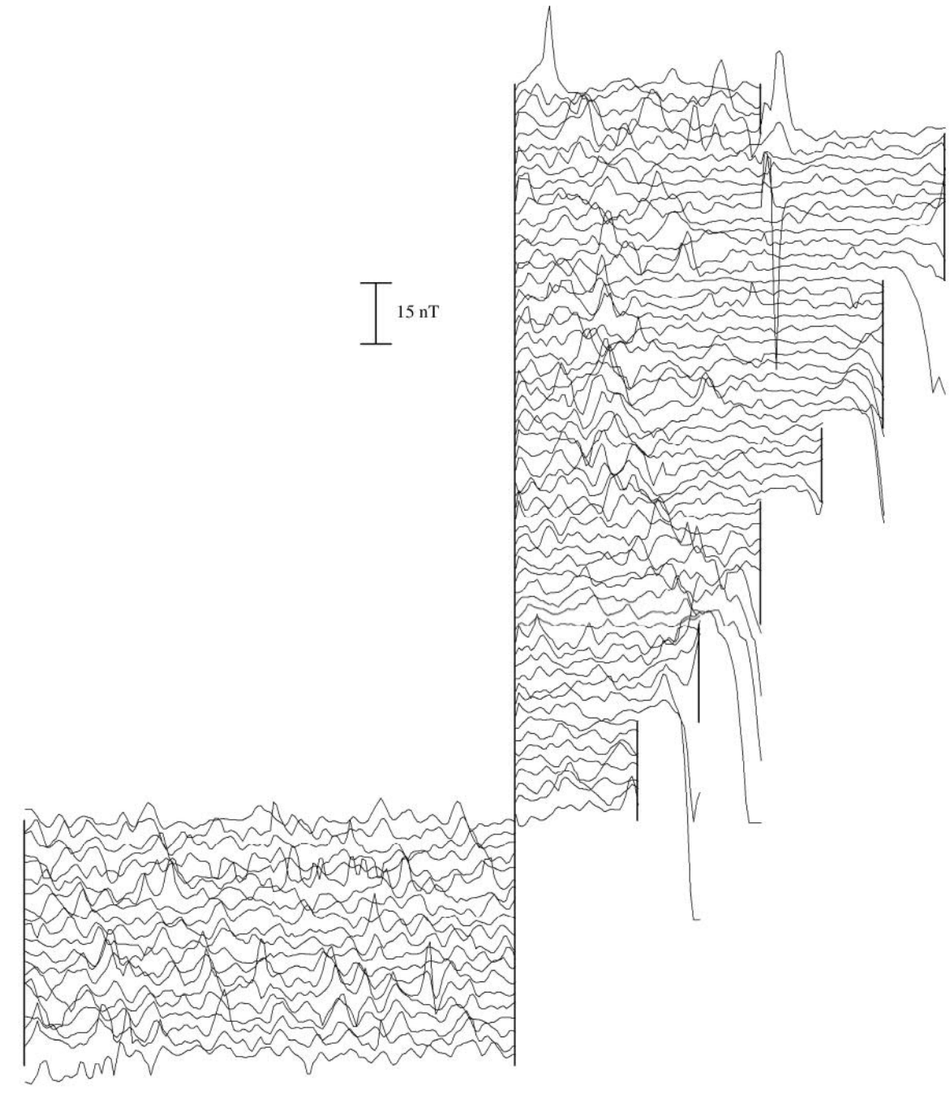
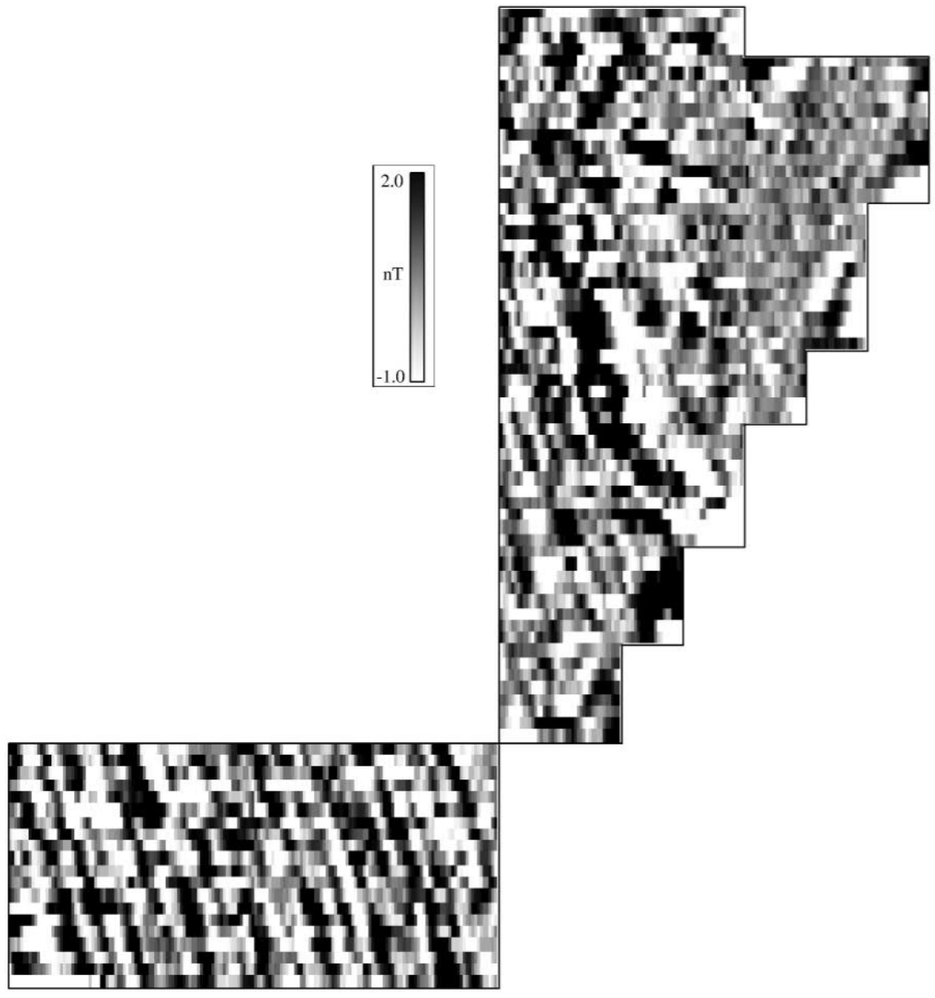
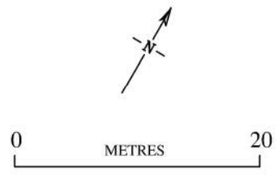
Geophysical Prospection For Archaeological Assessment
Apartment 25
Block 11
Gallery Quay
Dublin 2
Mobile: +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

AREA 17 ARCHIVE: XY TRACE & GREYSCALE
BALLYLONGFORD, CO. KERRY



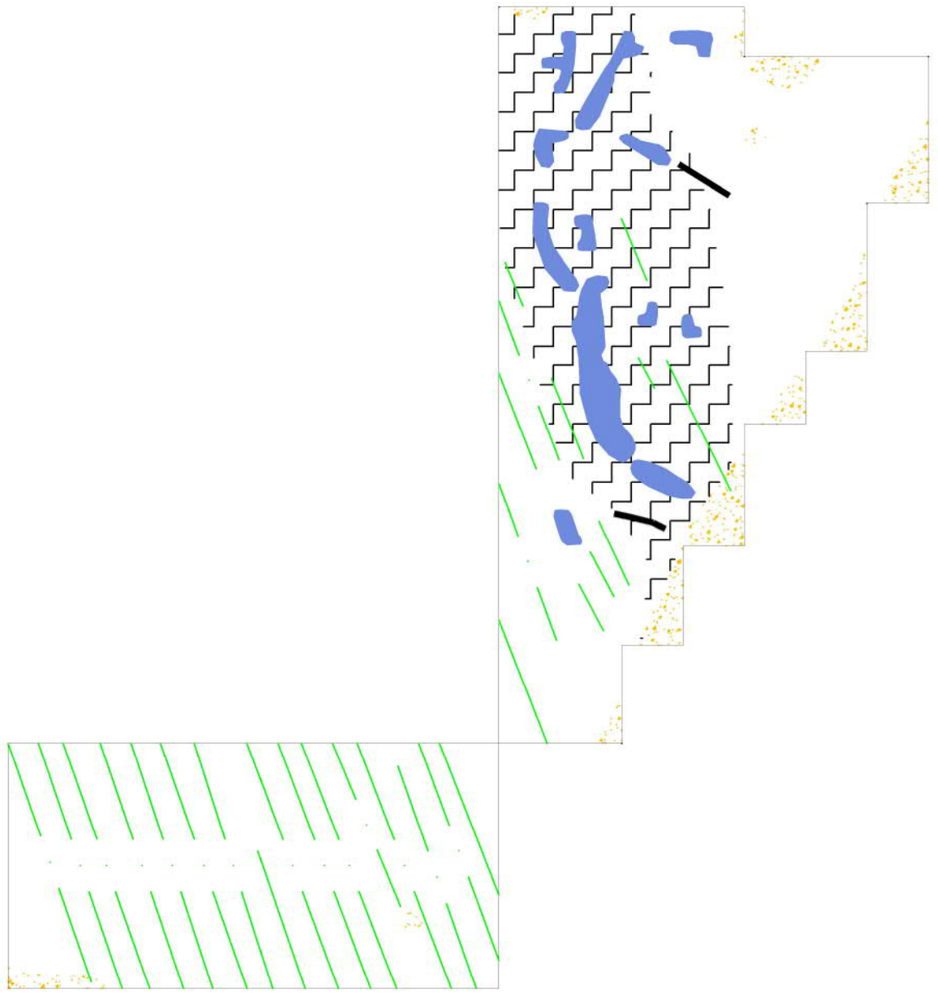




PROJECT: BALLYLONGFORD, CO. KERRY	TITLE: ARCHIVE, AREA 17: XY TRACE & GREYSCALE					
CLIENT: SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIGURE: FIG. 32	DATE: 20/10/06	SCALE: 1/500 @ A3	JOB NUMBER: 06/044	LICENCE NO. 06R0167	

TARGET Archaeological Geophysics
Geophysical Prospection For Archaeological Assessment
Apartment 25
Block 11
Gallery Quay
Dublin 2
Mobile: +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

AREA 17 ARCHIVE: INTERPRETATION
BALLYLONGFORD, CO. KERRY



? Archaeology Trend Cultivation Natural Ferrous

0 METRES 20

PROJECT: BALLYLONGFORD, CO. KERRY	TITLE: ARCHIVE, AREA 17: XY TRACE & GREYSCALE					
CLIENT: SHEILA LANE & ASSOCIATES ON BEHALF OF ARUP CONSULTING ENGINEERS	FIGURE: FIG. 33	DATE: 20/10/06	SCALE: 1/500 @ A3	JOB NUMBER: 06/044	LICENCE NO. 06R0167	

TARGET Archaeological Geophysics
Geophysical Prospection For Archaeological Assessment
Apartment 25
Block 11
Gallery Quay
Dublin 2
Mobile: +353 (0)87 858 0112
Tel & Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie

Summary Technical Information

Fluxgate Gradiometer Survey

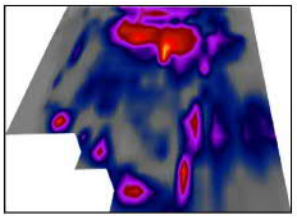
Surveys are undertaken using a Bartington *Grad* 601-single axis dual sensor gradiometer. The instrument has a vertical 1m sensor separation permitting finite resolution of buried archaeological features. Surveys are undertaken in scan or detailed (zig-zag traverse) modes for reconnaissance or high-density mapping. The fluxgate sensors are highly stable, minimizing requirements for excess data processing, and their dual or single configuration enables reliable flexibility during fieldwork. The instrument can be employed in both commercial and research based investigations allowing for completion of projects within short timescales. Regular grid sample densities from standard 1600 readings to 12800 readings per $20m^2$ grid are permitted.

A constant high quality of data is assured by experienced field staff operating in accordance to English Heritage Research & Professional Guidelines *Geophysical Survey In Archaeological Evaluation (David, A, 1995)*.

Electrical Resistance

The technique is used to record variations in electrical resistance by passing an electrical current through the ground. The standard instrument for archaeological investigations is a twin-probe array of mobile and remote electrodes maintained at a distance of about 20m. The mobile electrodes (one current and one potential, usually 1m apart) are mounted on a survey frame and connected to a Geoscan RM15 resistance meter, which records the specific resistance of the soil (measured in ohms). The resistance meter is connected to the pair of remote probes (one current and one potential), which remain in a fixed location. Data are collected as the survey frame and mobile probes reach each designated sample interval. Surveys are usually undertaken at 1 m sample intervals along 1 m traverses (i.e., 400 readings per 20m x 20m grid. The adaptability of the instrument enables increased sampling intervals, as well as a range of probe configuration to operate at varying depths.

Magnetic Susceptibility



Field and laboratory magnetic susceptibility measurements are taken by applying a low magnetic field and measuring the resultant magnetisation of the soil sample. The magnetic susceptibility of the soil is measured as a proportional constant of the resultant magnetisation of the soil and the applied field. The most common methods used to measure magnetic susceptibility are as follows:

Volume-specific magnetic susceptibility
The volume, or field, specific susceptibility method employs a hand-held Bartington MS2D field coil connected to an MS2 susceptibility bridge and measures the volume-specific susceptibility of the soil in SI units. The field-sampling interval is commonly 10 m.

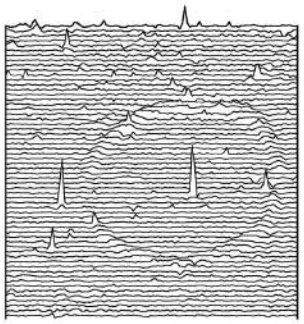
Mass-specific magnetic susceptibility
Mass, or laboratory, specific susceptibility measurements are taken using a Bartington MS2 susceptibility bridge connected to an MS2B laboratory sensor into which previously dried and sieved samples are inserted. Units of measurement are given in m^3kg^{-1},at 5m sample intervals.

**The relevant technical information for ground penetrating radar, phosphate analysis and further geophysical survey techniques are included as appropriate.*

Data Display Formats

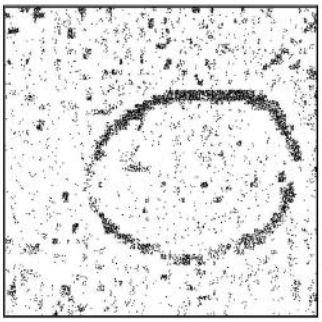
XY Trace

The data are presented as a series of linear traces, enabling a semi-profile display of the respective anomalies along the X and Y-axes. This display option is essential for distinguishing between modern ferrous materials (buried metal debris) and potential archaeological responses. The XY trace plot provides a linear display of the magnitude of the response within a given data set.



Dot Density Plot

Each datum is assigned a cell in which the intensity or number of dots displayed is proportional to the magnitude of the individual response. The visibility or presentation of responses within a given survey area is governed by numeric parameters specific to both soil morphological and archaeological conditions observed on site. Typically, the range of weak to strong responses is manifested by a low to high level of dot density. The format is useful for displaying gradiometer and resistance data particularly for identifying low-level responses.

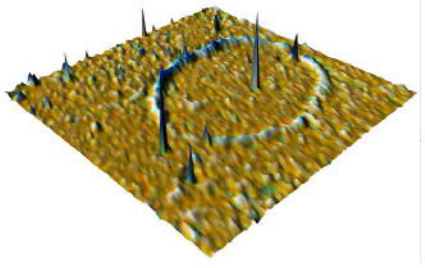


Greyscale

As with dot density plots, the greyscale 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 the given data set. This display method also enables the identification of discrete responses that may be at the limits of instrument detection.

3D Surface Plot

3D Surface plots employ selected colour scale, offset display, and relief plotting to replicate 3D view of datum across a given survey area. Perspective and orthographic projection, variable field view angle, rotation and tilt, are used to demonstrate the magnitude and breadth of responses.



**XY Trace and dot density plots are presented in archive form for display of the raw survey data. Summary greyscale images of the interpolated data are included for presentation purposes and to assist interpretation. 3D Surface Plots are included where deemed beneficial to the viewing and interpretation of the results from survey.*

Glossary of Interpretation Terms

Archaeology

This category refers to responses usually supported by comparative archaeological evidence (i.e., photographic transcriptions, excavation, etc). The term is generally associated with significant concentrations of former settlement, such as ditched enclosures, storage pits and associated features.

?Archaeology

This term corresponds to anomalies that display typical archaeological patterns where no record of comparative archaeological evidence is available. In some cases, it may prove difficult to distinguish between these and evidence of more recent activity also visible in the data.

?Industrial

Such anomalies generally possess a strong magnetic response and may equate with archaeological features such as kilns, furnaces, concentrations of fired debris and associated industrial debris.

Area of Increased Magnetic Response

These responses often lack any distinctive archaeological form, and it is therefore difficult to assign any specific interpretation. The resulting responses are site specific, possibly associated with concentrations of archaeological debris or more recent disturbance to underlying archaeological features.

Trend

This category refers to low-level magnetic responses barely visible above the magnetic background of the soil. Interpretation is tentative, as these anomalies are often at the limits of instrument detection.

Ploughing/Ridge & Furrow

Visible as a series of linear responses, these anomalies equate with recent cultivation trends.

?Natural

Resulting from localised natural variations in the magnetic background of the subsoil, these responses are often recorded in areas of low-lying land prone to flooding.

Ferrous

These anomalies exhibit a typically strong magnetic response, often referred to as 'iron spikes,' and are the result of modern metal debris located within the topsoil.

Area of Strong Magnetic Disturbance

This term refers to large-scale magnetic interference from existing services or structures. The extent of this interference may in some cases obscure anomalies of potential archaeological interest.

TARGET Archaeological Geophysics

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Apartment 25
Block 11
Gallery Quay
Dublin 2

Mobile: +353(0)87 858 0112
Telephone /& Fax: +353 (0)1 671 5292
Web site: www.targetgeophysics.ie
Email: survey@targetgeophysics.ie